Science and Mathematics Education Centre

Teaching and Learning with ICT in Western Australian Government Primary Schools

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DECLARATION

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Val Gray

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ABSTRACT

Have you ever wondered how far educators have come in response to the political push for improvements in teaching and learning with ICT? As a society, we have a responsibility to prepare young people to make a strong contribution to our future. This is characterised by rapid technological change in global communications and interactions. Since the early 1980s, governments around the world have committed vast resources to the provision of Information and Communication Technologies (ICT) in schools. This means that schools have been implementing the introduction of ICT for nearly thirty years!

This research examines how successful Western Australian primary schools and their teachers have been in implementing the use of ICT in teaching and learning. The research has been informed by a previous study that took place nearly ten years ago and resulted in the Pearson report (2001) and later the DET Teacher ICT skills survey (2005). The current research examined the role that leadership, teacher attitudes and professional learning played in ICT implementation. The study utilised a mixed methods approach to data gathering which included participant observations as well as auto-ethnographic methods.

The key outcomes of this research indicate that teacher proficiency and skills in utilising ICT in teaching have not significantly improved over time in the sample schools used in this study. This is despite successive Western Australian governments making substantial investment into new technologies, high-speed broadband and professional learning opportunities for teachers and schools.

The study concludes that for the successful integration of ICT into teaching and learning teachers and administrators must have time to develop and reflect on technology based pedagogy, as well as time and opportunities to engage in continuous, meaningful professional learning that not only considers the technical aspects but also new pedagogy and best practice to better meet the needs of their children. This can only be done if administrators and teachers change their attitudes and beliefs about how technology can enhance their teaching and learning. In addition, they must rethink the philosophical and pedagogical assumptions of education by making better use of the technologies that already exist in their schools by changing what we do in the classroom.

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ABRIVIATIONS and DEFINITION OF TERMS

There are a number of terms used in this report. The reason for this is that the definitions sources from the literature are not consistent. Different authors often use similar terms with slightly different meanings. To clarify any potential misunderstanding or misconception, provided below are the terms and definitions that are used in this Thesis.

The local education authority in Western Australia has undergone many name variations over time and these are used in this document at certain times. The names and/or ACRONYMS represent the same organisation. Some of the more commonly used ones are listed below:

EDWA Education Department of Western Australia

DET Department of Education and Training

DoE Department of Education

Other terms used throughout the document:

IT Information Technologies is commonly used to refer to processors, applications and equipment by which information can be accessed, created, communicated, organised, analysed or presented.

ICT Information Communication Technology - ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form.

Classroom A classroom is a room in which teaching and learning activities take place.

Integration the act of combining into an integral whole, for example in this context it is the application of technology into teaching and learning to assist, enhance and extend student knowledge.

Broad-band a general term used to describe cabling systems in which the bandwidth is divided by a frequency into narrow bands, with each able to be used for a separate data/voice/video transmission channel.

Computer any machine that does three things: accepts structured input, processes it according to prescribe rules and produces an output.

ICT literacy the ability of individuals to use ICT appropriately to access, manage, integrate and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society (MCEETYA, 2005).

PL or PD Professional learning covers both formal and informal training and resources for teachers, trainers, administrators and others working in education. Professional Development programs enhance the capabilities and performance of individuals and teams by building capacity, knowledge and skills in educators through internal, external and online courses. In this context the term Professional Learning and/or Professional Development is interchangeable.

OPL On-line Professional Learning

Technology is often used as the generic term to encompass all the technologies people develop and use in their lives. The United Nations Education, Social and Cultural Organisation (UNESCO), defines technology as:

> *...the know-how and creative processes that may assist people to utilise tools, resources and systems to solve problems and to enhance control over the natural and made environment in an endeavour to improve the human condition* (UNESCO, 1985).

Information is knowledge that is generated and used in everyday life. In the case of ICT - Information can be stored, retrieved and communicated using sound and/or visual images including print, numerical, pictorial and graphical representations.

CHAPTER 1

1.1 Introduction

Have you ever stopped to think just how far educators have come through the journey of integrating Information Communication Technology (ICT) and in particular computers, into everyday teaching and learning in primary schools over the past thirty years? This has been a curiosity for the researcher over the last twenty years and began by being thrust into the role of 'Learning Technology (LT) expert' back in the early days when the first 'Acorn BBC™ computers' hit Western Australian schools in 1987.

In the midst of the 'Acorn BBC'™ computer revolution arriving at the researcher's school (a rural school in country Western Australia) the principal asked staff if there was anyone who knew anything about computers. The researcher put up her hand saying she did and from this point forward was appointed the 'expert', given the task of setting up the computers and teaching staff and students how to use them. At the time she had an Amstrad 464™ computer at home and had been exploring just what these machines could do. The researcher knew a little about programming and how the computer basically worked. This pathway to ICT coordination in schools was typical across Australia (Dawes & Robertson 1991).

After the initial stages of seeking out and attending as much professional learning as possible the researcher began teaching and training staff on how to use learning technologies in their classrooms. As time went on, she applied and gained an acting position as Principal in an Education Support Centre where the use of learning technologies began to come into its own; promoting the educational needs of the students.

At this time, the Concept Keyboard became available. A Concept Keyboard is a flat board containing a grid of buttons. Each button can be programmed to perform

specific functions. An overlay sheet with pictures or symbols is placed over the grid and by pressing each grid area the user could see what can be done. This empowered the teacher to pre-program activities into the computer. Creating overlays provided the student with a visual clue, thereby enabling student to touch specific areas which the computer responded to and then processed and presented the specific information on a screen.

Other learning technology devices where used to assist the students in their learning. For the non-verbal students the use of augmentative communication devices for voice output enabled students to communicate with their teachers and peers. Ever since, the researcher has been exploring just how this technology has impacted on the way schools/teachers deliver their teaching and learning programs and how it has impacted on student learning.

Since the 1950's little technology, other than television, had made its way into schools, but from the mid 1980's the introduction of new technologies in the form of computer hardware increased (Lee & Gaffney, 2009). Governments around the world made a commitment to ensure all schools were equipped with the technology needed to educate students for the twenty first century and beyond.

Well! The twenty first century has arrived and during the time the researcher has been teaching she has seen and experienced substantial investment in technology with an emphasis on computer to student ratio, resulting in more hardware, cabling and networking in schools.

1.2 Research Context

ICT in schools and in particular, 'computers in education', has been a topic of debate over the past couple of decades for all stakeholders in education (Anderson, 1984; Dougiamas, 1998; Oliver & Newhouse, 1993; Newhouse, 2002; Lee & Gaffney, 2009;

November, 2010; March, 2011). Technology was and has been part of the secondary sector since the mid 1970's when Apple™ donated some PCs (*Personal Computers*) to American high schools but computer technology was a relatively new phenomenon in primary schools. It was not until the 1980's when the competition between Apple Macintosh and IBM™ and the many clones available, that computer software companies began targeting the education environment (Hermes, nd). Drill and skill programs for personal computers took off and interest in using computers in schools began in earnest. Even though this study investigates ICT in primary schools it is interesting to note that by the early 1970's and 1980's high schools began using DOS™ (Disc Operating System) based IBM clones but the primary education sector used predominantly BBC Acorn ™, if any at all (Anderson, 1984; Fleer, 1989; Downes, Fluck, Gibbson, Leonard Matthews, Oliver,… & Williams, M. 2002a; Tatnall & Davey, 2004).

The trend in Australia for the use of computers in primary education was developing around the same time (1986-87). In Western Australia the government of the time introduced Acorn BBC™ computers from Britain into its primary schools. These were purpose built for computer education and very advanced for the day (Downes, et al., 2002; Fleer, 1989).

The implementation of the Acorn BBC™ computer in British schools experienced varying degrees of success because of its cost. As computers began to be more affordable and the influences in the early 1990's of IBM™ microcomputers using a MS DOS™ (Microsoft Disc Operating System) began to take hold. The integration of DOS computers across both primary and secondary schools became more evident and with this came a shift from computer skills in isolation to a push toward a model of curriculum integration (Dunlap, 2002). Governments around the world have for years poured millions of dollars into their 'computers in classrooms' initiatives with the misguided view that more computers in the classroom equates to better outcomes for students (Katterns & Haigh,1986). They have failed to realise computers themselves cannot think or respond sensitively to changing conditions. Therefore, computers cannot replace the teacher and will not guarantee to make a difference.

However, they are useful tools to help arrange the conditions of learning in certain teaching situations (Katterns & Haigh, 1986; Resnick 2006). Mishra & Koehler (2006) suggest however, the heart of good teaching with technology needs to incorporate three core components of content knowledge, pedagogy and technology and that the relationship between them enables teachers to understand how to effectively teach with technology in the 21st Century and beyond. On the other hand Fluck (2003) argues great teachers will be great with or without technology; and bad teachers will be bad with or without technology and Cubin (2011) echoes this stating without regular use in classrooms, ICT advocates cannot even hope for increases in student academic achievement, transformed teaching, and technologically proficient students entering the job market.

Furthermore, it is the author's view, there needs to be a change in the way society views teaching and learning with a shift in teaching pedagogy. The attitude of the teachers' philosophy on education may be necessary to improve teaching and learning with ICT. Coupled with this, good quality Professional Development and quality teaching and learning programs is what will make a difference!

> *Getting the best from ICT depends on several variables: appropriate design of software and hardware; the training and attitude of teachers and the realisation that different students have different requirements. It requires a willingness to experiment with the effective use of ICT in education which is likely to require quite different pedagogical techniques from traditional classroom teaching. Technology is never a substitute for good teaching without skilled teachers, no electronic delivery can achieve good results but neither can traditional classroom teaching* (Cairncross, 2003).

Ellis (1988, p. 1) wrote "by the turn of the century, any person who is not computer literate will be as handicapped as those who cannot read and write today". However, despite many powerful visions of how technology can improve teaching and learning, the use of computers in schools continue to be limited (Bransford, Brown & Cocking, 2000; Coppola, 2004; November, 2010). The literature suggests more money needs to be allocated to the professional learning of teachers if ICT is going

to be implemented into the classroom effectively (Calvert, 2002; DuFour, 2004; Pearson, 2001; Smerdon, Cronen, Lanahan, Anderson, Iannotti & Angeles 2000; Trinidad, 2005). Therefore, is it the lack of money that impedes professional learning or is it more to do with other factors such as leadership and the decisions leaders make, how teachers' believe children learn or is it a combination of all three that hinders the integration/implementation of ICT?

> *As our use of Informational Communication Technology (ICT) has matured, the focus has now shifted from an overriding concern with skills and competences linked to technology itself toward engaging teachers and students in the potential of ICT to develop new teaching and learning styles (Denning, Fisher, Higgins, Loveless & Tweats, 2003).*

The intention of this study is to provide new insights from the grassroots level into the challenges that confront Western Australian Government Primary Schools who seek to integrate ICT into their teaching and learning. The study investigates the relationship between leadership, teacher beliefs and practices in the implementation of ICT as a tool in primary schools. A plethora of research (Cox, Abbott, Webb, Blakely, Beauchamp & Rhodes, 2003; Loveless & Ellis, 2001; Ofsted, 2001) has made reference to the changes in classrooms as a result of various governments and their 'computer in schools' initiatives. However, a change in teachers' pedagogical thinking has mostly remained static, minimal or even non-existent. According to Elmore (as cited in Coppola, 2004) the effectiveness of technology on students' access to knowledge is determined by the pedagogical knowledge and skill of teachers. He wrote in his forward for Eileen Coppola's book 'Powering Up' that "technology enables teachers with well-developed working theories of student learning to extend the reach and power of those theories; in the absence of these powerful theories, technology enables mediocrity" (Coppola, 2004, p. xii).

Many studies have highlighted barriers or constraints that impede teachers making a shift from 'traditional' teaching to a more flexible and integrated (constructivist) approach (Smerdon, et al., 2000). According to Mumtaz (2000) pedagogical beliefs, technical skills and confidence, in what he calls 'teacher barriers' are the main

factors affecting the integration of ICT into teaching and learning. While, Cox et al. (2003) explained that time to develop effective pedagogy that includes ICT involves considerable effort in terms of planning, preparation and ongoing support. Therefore, not acknowledging and acting on these barriers identified by Mumtaz and Cox et al. may lead to the ineffective implementation of teaching and learning with ICT.

> *Today, perhaps more than ever before, it is important to recognize that learning is a lifelong experience. Rapid, radical changes in contemporary society demand well planned, continuing efforts to assimilate new data, new insights, new modes of thinking and acting (To Teach as Jesus Did, 1972).*

Over the past three decades, modern technologies have transformed many aspects of Australian life. Demands have changed as a result of this digital/knowledge revolution and so has skills and knowledge students will need to become successful adults. Therefore, technologies, in particular computers and the Internet, have become a major focus of policymakers in recent years. Government and system initiatives have provided some schools with computer hardware; software, high-speed broadband Internet connection and some technology focused professional learning. However, as a number of computers and access to the Internet in education has grown so have the questions being asked about how these technologies are being integrated into teaching and learning to improve student outcomes (Fluck 2003).

Since the 1780s the educational model for schooling around the world has been one of teacher/manager with the teacher as the sole deliverer of instruction and assessment in the classroom. This model has persisted through the 1800s and 1900s and still exists in many schools around the world today (Anderson, 1984; Gillard, 2004; McCreadie, 2006). Under this model of a single classroom with a teacher directed method of delivering information, technology has not been widely accepted even though multimedia PCs have been in schools since the early 1990s. By 1994 most classrooms around the world had at least one computer for instructional delivery (Anderson, 1984). In 1997 the Western Australia Department of Education

implemented its 'Internet in the Curriculum' professional development (PD) program to assist teachers in making effective use of the internet for curriculum and professional purposes. However, the researcher's personal opinion is that not all teachers had access to a computer for instructional preparation therefore this strategy was not as effective as it could have been.

Governments around the world have been committed to the provision of ICT in education since the early 1980s as evident in the literature (Downes et al., 2002; Eadie, 2001; Jenkins, 1999; Ministry of Education New Zealand, 2003; OECD, 2001; Ofsted, 2004; Prior & Hall 2004). Today, Information Communication Technology (ICT) is recognised by educational authorities as a vital component of classroom practice. However, many teachers have failed to embrace ICT as a teaching tool. One of the many pitfalls identified by researchers (Bowman, 2004; Downes et al., 2002b) into the integration of ICT into the classroom is the issue of access, confidence and competence of the teachers to use the technology.

The Australian context is no different. Elliot (2004) stated that Australia is a leader in ICT and education, with policy makers attempting to transform teaching and learning through the use of ICT. Despite there being nearly thirty years since the introduction of technology to schools, "many teachers still have little confidence with technology, let alone the ability or interest to integrate ICTs in their teaching" (Elliot, 2004).

Cuttance (2001) believes "the integration of ICT into all social institutions and organisations means that the necessity to equip students with the capacity to understand and utilise the potential of such environments is no longer an option but an imperative" (p. 73). Rickards (2003) asserts it is not about gaining access to new technologies or the Internet but having the skills to effectively utilise it in meaningful ways. He maintains having a technology-rich environment does not ensure high quality teaching and learning because teachers can demonstrate high quality outcomes through effective pedagogies whether they use technology or not. While Trinidad and Pearson (2005) maintain interactive technologies make it easier to

create pedagogically sound environments whereby students can learn by actively participating, receiving feedback and continually refining their understandings to construct new knowledge. They argue that "using ICT in education is about people not just the technology, and helping people understand what good learning is about and how to build sound learning environments that can be supported by ICT" (Trinidad & Pearson, 2005).

> *Learning with ICT offers students a world of opportunity; global communication, access to timely and relevant information sources, engagement in rich, relevant tasks based on real situations and data. Student learning is always at the centre and ICT exists as one of a number of technologies to enhance learning (Department of Education and Training Western Australia, 2004).*

As ICT is almost ubiquitously available in society it is impacting on schools as they face profound challenges (Kennewell, Parkinson, & Tanner, 2000; November, 2010; Rickards, 2003; Watson, 2001). Over the past one hundred years school systems around the world have been designed to accommodate the thinking of the industrial era. Now schools are faced with the challenge of leading the students into the 21st Century and beyond into the knowledge era (Lee & Gaffney, 2009; Warner, 2006).

In order to overcome the issue of inadequate resourcing the Western Australian Government, along with many other governments around the world, began to increase the funding available for technology integration in their education systems. In 1998 the Western Australian Government invested twenty million dollars in the 'Computers in Classroom' project to assist schools to increase the number of computers in classrooms. The monies allocated were specifically for the acquisition of hardware and connectivity. Since 1998, millions more have been invested in a range of projects to meet the needs of the global community to educate students for the future. Governments across Australia have acknowledged the importance of ICT in knowledge development by endorsing the 'National Goals for Schooling in the 21st Century' in April, 1999 (MCEECDYA, 2010). A number of to the department's

initiatives have been implemented with the aim of increasing schools access to ICT. This has been in response to the increasing demand on teachers to integrate ICT into their teaching and learning in ways that will enhance the learning outcomes for students.

A report from the office of the Auditor General (Pearson, 2001) indicated that over 95% of the teachers interviewed assess themselves as having more than the basics to deliver ICT operational skills. The majority of teachers were not, however, confident about applying ICT to facilitate student learning (Pearson, 2001). These outcomes were consistent with the teachers self-reports collected by the DoE in the development of the Learning Technologies Planning Guide for Schools using Information Technology to improve Teaching and Learning in 2000. As a result of these reports, the Department of Education in Western Australia put forward many initiatives to improve teacher confidence and competence in integrating ICT into teaching and learning.

Under the National focus, the Western Australian Department of Education is investing in various technology projects to increase the knowledge and understanding of ICT in the curriculum. It was the introduction of technology into primary schools which came about in 1987 through the computers in school project, that IBM became affordable. The Internet was developed and 10 years later, in 1997, the Department implemented the Internet in schools program whereby selected members of each school were trained using a 'Train the Trainer' method of professional learning. This was an effective way of training large numbers at minimal cost and disruption to the school.

The Technology 2000 project was initiated to support schools using information technologies to improve teaching and learning. There is compelling evidence that with appropriate teaching and learning techniques, learning technologies can improve a student's learning style. The Department realised many schools are in fact expanding their use of computers as tools for learning across a range of

learning areas. By incorporating learning technologies into the school curriculum, and developing students' IT skills, it positions students for their introduction into the workforce (Department of Education, 1997).

The Department acknowledged that implementing and managing learning technologies so they are efficient and effective in their purpose across a school required detailed planning, leadership and co-ordinated effort. Hence, to meet this need DoE developed the Technology 2000 strategy.

In general, the research on teacher change and instructional reform indicates that changing teacher practice is often slow, minimal, or even non-existent (Ball, 1990; Cohen, 1990). To support schools in their implementation of ICT the Department invested in the 100 schools initiative in 2002. Under this project one hundred schools in Western Australia were selected to receive, over a three year period, large sums of funding to have high-speed networking facilities, upgraded computer student ratios and professional learning for staff. These schools became 'lighthouse schools' with the aim of supporting other schools in the implementation of ICT.

However, teachers did not always have the opportunity to learn about and practice instructional reform. Therefore, in 2005 further funding was sought from the government to extend the program to include more schools since research indicated teachers were more likely to integrate ICT into their teaching and learning if they had access to adequate equipment and high-speed Internet connection. This program became known as LwICT (Learning with Information Communication Technology).

In Western Australia, ICT has been implemented in varying degrees in the public schooling sector. DETWA has attempted to improve the integration of ICT into public schools by investing another eighty million dollars through the introduction of various ICT initiatives. One recent initiative was the 'Learning with ICT (2002 - 2009). Formally the 100 schools project', the aim of this project was to improve

teacher competencies, both professionally and personally, in the use of ICT. It also sought to enhance the learning opportunities for students across all government schools. The overall strategy was to improve learning opportunities for children by utilising the latest in Information Technology. The Government provided funding for appropriate professional learning, curriculum and technology support services and, where required, the implementation of new or upgraded information and communication technologies. The implementation phase of the Project was completed in November 2009 and currently 211 schools across Western Australia have migrated to the Standard Operating Environment (http://intranet.det.wa.edu.au/groups/ict_lwict/overview.asp)

In 2006 the Department initiated the 'Online Teaching and Learning System' (OTLS). This is one of the services provided through the Online Curriculum Services initiative and provides teachers with an online environment to plan, deliver, monitor and evaluate online and blended learning programs. OTLS gives opportunities for students to participate in self-paced, engaging online learning experiences in a safe secure environment. Through the DET Portal and OTLS, teachers have access to a wide range of teaching resources from suppliers such as the Learning Federation, WestOne Services and the Department of Education and Training. These resources include digital learning objects, images, audio and video clips from national archives, information organisers and thinking tools for students, in addition to information about curriculum-related websites and print materials.

Another service provided by DoE (Department of Education) is the 'Online Professional Learning System' (OPL). It is the DoE's platform for delivering and managing online professional learning opportunities for staff. OPL is available to all DoE staff through the portal. As part of the professional learning opportunities DoE provides a FREE online professional learning program for teachers using the SchoolKiT's pd21 program 'Teachers have Class'. 'Teachers have Class' provides relevant and practical online self-paced, on demand and instructor-led courses focussing on technology integration with best practices pedagogies in teaching and learning to achieve maximum outcomes for students.

(http://www.det.wa.edu.au/curriculumsupport/ocs/detcms/navigation/professional-learning-for-staff/teachers-have-class-/)

This research is unique as it seeks to contribute to a better understanding of some of the key factors that may impede or influence Western Australian primary school teachers to integrate ICT into their teaching and learning. This study will examine if there has been any change in the delivery of teaching and learning, curriculum delivery and student outcomes in Western Australian government primary schools. The Department of Education in Western Australia (DoE) is one of the biggest employment agencies for teachers in Australia. DoE employs over thirteen thousand primary school teachers in six hundred and seventy primary schools drawing from a wide geographical area that covers one third of the Australian continent. It has 34% of its teaching population under thirty nine years of age, with 56% being forty to fifty nine years and 7% aged sixty plus years (http://www.det.wa.edu.au/teachingwa/detcms/portal/).

Over the years there has been increased investment in ICT. Since 1998, when the Western Australia Government announced the first of many initiatives aimed at improving the ratio of computers to students in schools, to the 'Digital Revolution' of today. The aim of these initiatives has been to improve student access to learning technologies, specifically computers. As a consequence, many schools across Western Australia have cutting edge ICT networks along with broadband connections to the Internet (Department of Education, 2010). However, due to the vast area of WA there are still many schools that have no or limited access to a reliable internet service let alone up to date technologies with high speed broadband connection (Rabbitt & Pagram, 2002). For example, B Jones (personal communication, November 22, 2010) informed the researcher that even though her school was only a hundred kilometres from the metropolitan area, staff did not have access to high speed broadband or departmental features such as webmail.

Even taking this into consideration it appears teachers are still not consistently integrating technology into their teaching and learning. Kleiman (2004) states "however, in many places, the myths persist, and progress has been limited. A great deal of technology lies unused in schools". The computers and wires may be there, but the plans to put them to good educational use, the preparation necessary for the teachers to use them well, and the support needed to ensure they will work when needed are lacking. We continue to see computers used in ways that are peripheral, rather than central, to the curriculum and important learning goals (Kleiman, 2004; November, 2010). At the moment it is unclear as to why this is happening. There is a lack of current research, particularly research into Western Australian government primary schools.

> *The coming knowledge-based society will demand of all its members a high level of competency in dealing with information and information technology. All students must share access to adequate opportunities to develop their abilities to use computers and information networks. This is acknowledged by the State government by its decision to fund very substantial increases in the numbers of computers in the primary and secondary school (National Report on Schools in Australia, 1998, p. 132).*

According to Downes (2004) "the evolution of new technologies passes through two distinct stages". This is no different for the introduction of information technology into schools. Downes believes we have passed through the first stage of equipping classrooms with technology and that we are moving toward changing and replacing the physical classroom environment with electronic lessons. It is suggested by Downes the second phase is beginning to appear where we will see the use of technology change and advance beyond what is possible in the classroom. The use of ICT as a tool for learning has the potential to motivate and engage all students in the learning process. Nevertheless, regardless of this change teaching and learning remains the same (Coppola, 2004; Kleiman, 2004; Lee, 2009). Lee (2009, p. 32) infers "those who were visionaries in the early stages of ICT implementation are now reaping the benefits of moving their schools towards a digital mode of schooling while the 'tinkerers' continue to provide a traditional and increasing archaic model of schooling".

Since the early 1980's education in Western Australia and nationally in Australia has seen an infiltration of computers in classrooms. This has led to the rebirth of the thinking classroom, including Dr Howard Gardner's multiple intelligence and critical thinking (Monteith, 2004). Critical thinking is described by Scriven & Paul, (2001,) as ″the intellectually disciplined process of actively and skilfully conceptualising, applying, analysing, synthesising and/or evaluating information gathered from, or generalised by, observation, experience, reflection, reasoning or communication, as a guide to belief or action [or argument]″.

It has long been recognised by many educational leaders and researchers that teachers, schools and systems are having difficulty coming to terms with some of the contradictions between key learning principles and practices on the one hand and the pressure of accountability and traditional school culture on the other (Seaton, 2002). Barrett (1999 as cited in Seaton 2002, p. 10), stated research is finding that students between the age of 10 and 15 are 'switching off' and they need to have opportunities to negotiate learning which is as useful now as well as in the future. Seaton states a "coherent curriculum is focused on the identified needs, interests and concerns of students along with the emphasis on self-directed and constructive learning". He believes primary schools have a long way to go in terms of providing students with opportunities to construct understandings as they use and analyse text in real context for personal and social purposes. Seaton (2002) suggests teachers in a work-oriented classroom concern themselves with information transmission focusing on mastery of predetermined outcomes, whereas in a learning-oriented classroom teachers facilitate the construction of knowledge through an emphasis on problem solving and open ended activities which are connected to the students' values, interest, purpose and life worlds. Wilks (2005) noted "the mapping of student learning across the compulsory years of schooling, (Hill & Russell, 1999) and revealed what many practitioners had suspected that there was virtually no growth in students' learning during the middle years of schooling (Years 5 – 8)".

The thinking classroom is not a new phenomenon. It has been around since the early 1950s when Piaget and then Vygotsky in the 1980s talked about constructivism.

Vygotsky believed that "children learn when they can make links with previous learning because they can extend their existing conceptual mental map with new learning" (Wallace, 2001, p 7).

It has been recognised and proposed by many leaders in education and research, for example, Atkin (1997) and McKenzie (2003a; 2003b) that the use of ICT as a tool can and will assist teachers and students to become engaged in learning and have a higher level of self-direction. Governments are investing huge dollars in introducing ICT into education to promote this philosophy of making learning more student-centred, collaborative and to encourage cooperative, creative problem solving (Kimber & Deighton, 1999). However, as in the words Sivin-Kachala & Bialo (2001) "technology can improve teaching and learning, but having technology doesn't automatically translate to better instructional outcomes". Higgins (2003) concurs and adds "there is evidence that ICT can help students learn and teachers teach, however, simply having more computers does not make a difference".

In 2009, Lee noted that the second stage of the digital revolution began to take off in the late 2003 early 2004 when technology became readily available and at an affordable price for schools. He found that with the introduction of the Interactive Whiteboard and the data projector digital technologies could be used to assist the whole class teaching. However, "reactive scenarios are still very much in a majority in schools, education authorities and indeed nations" (Lee, 2009, p. 32).

With this investment have come a number of questions about the extent to which technologies are being used in teaching and learning and for what purpose. In primary schools today, some teachers are beginning to use computers in the teaching and learning program as a tool to improve student learning but in many cases this technology sits idle because teachers lack the skills and knowledge to implement them successfully (McKenzie, 1999a; 1999b).

The professional development of teachers and the training of new teachers in the use of ICT, (especially online technologies) is a major concern. Gipson (2003) believes the adoption of ICT in society is demanding that schools produce graduates who are literate in the requirements of the workplace and in the conduct of daily affairs as students today are net students and they use technologies consistently in their daily lives. Teachers need to accept that "students will learn differently, that they have to developed different skills, and in some cases at a higher level than their teachers" (Gipson, 2003, p 137)

1.3 Origins of this Thesis

> *When students leave school they should be confident, creative and productive users of new technologies, particularly information and communication technologies, and understand the impact of those technologies on society (MCEETYA, 2001).*

Computers in schools, especially in primary schools, have been questioned over the past couple of decades (Jeffries, 2000; McKenzie, 1997; Newhouse, 2002; Ofsted, 2001). Educators have discussed how computers should be used to support learning, and what improvements in student learning could be expected. Elliott (2004) states in many ways Australia has been a leader in ICT and education since the earliest days, but twenty years on, teachers still have little confidence, ability or interest to integrate ICT into their teaching. Jefferies (2000) advocates "educators need to embrace the idea of technology integration and face the realization that it is not a fad, but a viable instructional tool that is every bit as valuable as the textbook and worksheet".

MCEETYA (2005) reports that the coming knowledge based society will demand of all its members a high level of competence in dealing with information and information technology. All students must have access to adequate opportunities to develop their abilities to use computers and information networks. Newhouse (2002) argues that educators are becoming more focused on the use of technology to

improve student learning, and so this became the rationale for investment. While Rogers (2004) and McKenzie (1999) highlighted that even though computers have been in schools since the early 1970s, they have failed to deliver the transformation in learning that has been promised and promoted. Computers have never really had an impact on the teaching and learning program because of their limited numbers, lack of suitable educational software and teachers' lack of knowledge and understanding of what a powerful tool ICT can be in teaching and learning. Hennessy and Deaney (2004) reported that governments around the world began investing substantial amounts of money into the implementation of ICT into teaching and learning with varying degrees of success in 1997. With this investment have come a number of questions about the extent to which technologies are being used in teaching and learning and for what purpose.

In 1998 the Western Australian government provided $20 million for the Computers in Schools Project. Then in 1999 the government injected a further $80 million into the Education Department of WA (EDWA) for the provision of learning technologies. This was to build on the previous initiatives to ensure a technology focus in schools with an emphasis on integrating technology into the curriculum as a teaching and learning tool.

In 2001 the Western Australian Auditor General, Mr Pearson (2001), conducted a report called 'On-line and length? - Provision and use of learning technologies in Government schools'. This report was prepared to provide Parliament with an assessment of the effectiveness and efficiency of new technologies in public sector programs. Identified in the report was that while computers were in schools at the projected ratio of 1:10 in primary schools and 1:5 in high schools, the teachers were not integrating the technology in their learning program since little consideration had been given to professional training (Pearson, 2001).

Pearson (2001) revealed "the bulk of the professional learning had focused on developing computer skills rather than on how to integrate new technologies into

teaching and learning programs". The report noted the professional development (PD) undertaken by teachers was marginal or of no use in relation to their teaching and learning. It was found that while a majority of teachers were making some use of learning technologies, their level of integration into the curriculum was slow because of inadequate access to computers, lack of adequate computer maintenance, limited or inappropriate professional development and infrastructure problems. It was found that there was substantial variation within and between schools at the level and use of integration of learning technologies and ongoing support was required by teachers to assist in furthering integration into teaching and learning programs (p. 8).

A recommendation from Pearson's report was that EDWA place greater emphasis on applying learning technologies to the school curriculum rather than simply achieving a target of computer/pupil ratio. This meant EDWA needed more accountability for the money allocated to the implementation of ICT in schools as well as promote more effective integration of ICT into the curriculum by focusing on PD, promoting shared knowledge amongst educators and pursuing strategies for hastening the integration of learning technologies into the teaching and learning (Pearson, 2001).

In 2002 the West Australian Minister for Education announced a further $17 million in funding for the '100 Schools Project' (now known as LWICT- Learning with ICT project) which resulted in the states neediest schools receiving an upgrade in computer technology along with funding for teacher PD to assist in the implementation of ICT as a learning tool into the curriculum. Also underpinning this initiative is the notion for teachers to support each other in the use of ICT within learning environments. Raising teachers' competencies in the application of technology in the classroom and changing teacher pedagogy in the use of ICT to enhance student learning as recommended by Pearson in 2001. However, while this project is commendable in its attempt to break down barriers surrounding the implementation of computer technology in learning programs, it has left an inequity in schools, especially in country and remote schools where reliable access and training is an issue (Intel Business Centre, nd).

> *A key component of the Department's e2c strategy is the planned replacement of information and communication technology (ICT) infrastructure in schools coupled with appropriate professional learning, curriculum and technology support services.*
>
> *Government has provided funding for the implementation of new schools information and communication technologies in 100 schools over the next four years.*
>
> *(http://www.e2c.wa.edu.au/100schoolsproject/schoolcommunity/about.htm*

As a curriculum manager and administrator, the researcher has a vested interest in knowing what is happening within the classroom and how teachers (in general but in particular in her school) are implementing the Department of Education (DoE) initiatives. She has a keen interest in ICT, and believe that as a tool, computers and other related technologies will assess students to develop and foster a love for lifelong learning.

1.4 Purpose and Rationale of the Study

It is fascinating how other systems have implemented ICT into teaching and learning. The purpose of this research is to find out why use ICT in Western Australian Government primary schools, what is the pedagogical justification for investing in ICT in Western Australian Government primary schools and what factors lead to the successful implementation of ICT. From experience and discussion with other educators the anecdotal evidence suggests very few teachers reported having received effective professional development for the integration of ICT into their classrooms. In the researcher's school, they have the hardware and connectivity to cater for the student population, but due to the teachers' lack of understanding, confidence and knowledge of ICT these technologies are not being used to their full potential.

The impetus for this research stems from the recommendations made by Pearson (2001), the research carried out by the Western Australian Department of Education and Training (DET) in 2005, the resources, both financial and human, invested over the past 30 years and the expectation by the Department of Education and Training (DET) that teachers will integrate ICT into their teaching and learning.

It is the researcher's intention through this research to investigate how far educators have come since the Auditor General's (2001) report and to look at a more affective and appropriate way of providing ICT professional learning to all staff across the state regardless of their location or school size and to gain a better understanding of what teachers believe make for best practice especially in the implementation of the ICT into teaching and learning.

A plethora of research (Cox et al., 2003; Loveless & Ellis, 2001; Ofsted, 2001) has made reference to the changes in classrooms as a result of various governments and their 'computers in schools' initiatives. However, a change in teacher's pedagogical thinking remains static or measured (Meadows & Leask, 2001). Many of the same studies have highlighted the barriers or constraints impeding teachers in making the shift from 'traditional' teaching to a more flexible and integrated (constructivist) approach.

According to Mumtaz (2000) pedagogical beliefs, technical skills and confidence in what he calls 'teacher barriers' are the main factors affecting the integration of ICT into teaching and learning. While, Cox et al. (2003) explained that time to develop effective pedagogy that includes ICT involves considerable effort in terms of planning, preparation and follow up. According to researchers like Mumtaz (2000), Cox et al. (2003) and Ertmer (2005) these barriers are what impede teachers from integrating ICT into their teaching and learning.

Prensky (2001) states teachers and students do not think about and use technology in the same way and suggests that students today "are no longer the people our educational system was designed to teach". Prensky (2005) stated teachers are 'digital immigrants' while the students they are teaching 'digital natives'.

An important aspect of this study was to examine the barriers to pedagogical change. It has been argued that by using the technology you can change the pedagogical approaches teachers use to better motivate and engage students in the learning process and improve learning outcomes (Curriculum Council, 2005; Elston, 2007). This use of technology as a change agent may require having a driver of change present in individuals or the school community (Fullan, 2011). This study seeks to investigate to what extent teachers utilise the technology that is already at their disposal as one measure of the effectiveness to the view that drives pedagogical change via technology investment in schools. Therefore, the purpose of this research is to examine the extent to which teachers in a Western Australian Primary school, who are technologically well resourced, utilise the ICT at their disposal. The study also examined the extent to which their pedagogy incorporates technology to improve teaching and learning and the factors that lead to effective technology integration.

1.5 Research Questions

To gain a greater understanding of how teaching and learning with ICT may improve outcomes for primary school students, this study set out to investigate two main questions:

1. Why use ICT in Western Australian Government primary schools?
2. What are the pedagogical justifications for investing in ICT in Western Australian Government primary school?

To do this a series of sub questions will be investigated using a theoretical framework that has been used for investigating Motor vehicle cash incidents. This

model utilises three elements: The environment (System/schools), the driver (teachers/administrators) and the Vehicle (policies/applications and outcomes). The purpose of this model is to identify from within multiple factors the contribution of each of these factors and to the input that each may have to the end result. The Crash Investigation model was selected to arrange data from this study as it allows a clear organisation of several key factors as identified in the research questions. These are detailed below.

The environment (System/schools)

3. What support structures are required to encourage teachers to make pedagogical change for the successful implementation of ICT in the classroom?

4. What school cultures are most supportive of pedagogical change for the successful implementation of ICT in the classroom?

The driver (teachers/administrators)

5. What implications does teacher attitude play in successful implementation of ICT in the classroom?

6. What role does leadership play in the successful integration of ICT into the classroom?

The vehicle (policies/applications and outcomes)

7. What skills do teachers need in order to empower them to integrate ICT effectively in the classroom?

8. What role does professional learning play in the successful integration of ICT into the classroom?

1.6 Overview of this Thesis

This study comprises of six chapters, followed by references and appendices. This first chapter has set the scene by providing background information through an introduction and research context as well as providing a brief overview as to the

origins of this Thesis in regards to ICT into primary schools. It introduces and summarises the purpose of this study including the research questions.

Chapter 2 begins with the literature review which presents an overview of the research carried out locally by other educators in the field of ICT implementation in schools. It begins by reviewing international, national and local research literature and the barriers to implementing ICT in primary schools, the role of leaders in the implementation and the beliefs and practices of teachers about the value of ICT in teaching and learning. Extra emphasis has been placed on more recent studies; 1997 onwards due to the changing nature and increased availability of new technologies and their role in educational reform in schools.

Chapter 3 presents an overview of the methodology used in this study and the rationale for using a mixed mode (qualitative/quantitative) research. It describes the process used to gather the data and explains how data was analysed. This chapter also explains how the research was conducted an investigation is work carried out.

Chapter 4 details the results and findings and follows on with the analysis of results presented by the data collected through surveys, interviews, personal stories and case study as related to the questions presented in Chapter 1. This section contains the findings of the teacher and leadership questionnaires, interviews and case studies conducted with principals and teachers from schools in Western Australia in regard to the implementation of ICT in Government primary schools.

Chapter 5 presents the discussion and implementations for managers and future school leaders in implementing ICT as well as sustainability of new technologies in education.

Chapter 6 presents the conclusion of the study and gives some direction on where further research could be carried out.

Following the references are the appendices. These provide a full set of teacher and leadership questionnaires and interview questions as used in this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to review the research evidence and literature available on the integration of Information Communication Technology (ICT) into primary education and what is known about teaching and learning with ICT in primary schools. For the purpose of this thesis it can be divided into two parts. The first examines what is happening in the field of ICT without specific reference to schools and classrooms. The second considers ICT from an educational point of view, attending in particular to factors that have been associated with the integration of ICT into teaching and learning in the primary setting. Because the field is so large and the issues canvassed so diverse and technical, the chapter is limited to the following considerations:

- History of ICT in primary education
- Integrating ICT into primary education
- Pedagogy and integrating ICT into primary education
- Association between teacher attitudes, leadership and school culture in effective ICT integration in primary education

2.2 Background

This literature review begins by exploring past research on how ICT is being integrated into teaching and learning. This review has considered international, national and local research literature and examines potential inhibiting factors for the implementation of ICT in government primary schools. Also the role of leaders in the implementation of ICT and beliefs, practices and professional learning of teachers with regard to the value of ICT in teaching and learning is examined. The literature is discussed with regard to the application of ICT including leadership in the implementation of ICT, teacher attitudes and beliefs regarding ICT and professional learning. The findings from previous international and national studies help to establish the current context of this research.

2.3 Brief History of ICT in Primary Education

The industrial age gave way to the information age in the late fifties and early sixty's with the commencement of the space program and the launch of Sputnik. The Sputnik program heralded the beginning of satellite communication. This encouraged a shift from blue collar workers to white collar workers (Bitter & Pierson, 2005). With the space race in full swing during the 1960's and a rapid advancement of technology, the move away from the industrial age to the information age gained momentum. Global economies that were built on information rather than goods and services began to emerge. This dawning of the information knowledge age had strong implications for education and, according to Bitter and Pierson (2005), three trends began to emerge:

- A shift in demographics;
- An acceleration of technology; and
- An ever expanding base of available data.

Most Children today have not lived or grown up in a non-computerised world. Even in third world countries new technologies are becoming available (Markoff, 2006; http://laptop.org/en/) and "schools are as responsible for providing access to any opportunity to learn and use technologies as are families" (Bitter & Pierson, 2005, p. 2). The ever expanding sources of knowledge in today's society has left educators asking what skills, concepts and information students really need just to participate in the future. (Bitter & Pierson, 2005, p. 3). Life will be very different for students in the next decade and beyond with the ever changing pace of technological advancement, but the current education system is not adequately preparing students for the kinds of occupations and lives they are likely to encounter in their lifetime. Therefore, the way in which teachers teach in today's world needs to change to enable students to become thinkers, problem solvers and creators (November, 2010; Dinham, 2010; Schrum & Levin, 2009; Bitter & Pierson, 2005, McKenzie, 2003b; Papert, 1993a). The educational system is regarded as the force that, when functioning properly, provides literacy and when failing allows illiteracy (Bitter & Pierson, 2005).

Policy is the driving force behind what is taught in schools and so it is important for this literature review to examine the various policies influencing teaching and learning with Information Communication Technology (ICT). Across the globe ICT in teaching and learning has been a topic of debate for many years in all education sectors. Business has accepted the burden of retooling and retraining its workforce, however the costs cannot be incurred indefinitely. Therefore, education must share the responsibility of developing technologically literate people, not only to help maintain **a** standard of living but also to help create a balanced lifestyle (Bitter & Pierson, 2005).

In the late sixty's Seymour Papert, considered the world's foremost expert on how technology can provide new ways to learn, advocated the power of new technologies in education (Wright, 2002; November, 2010). However, since the 1970's three generations of students have moved through the school system with their experiences in new technology, namely computers, very much dependent on the local education authority's vision and financial priorities (November, 2010).

In many cases, according to Bitter and Pierson (2005), these students have left school less prepared for the demands of the workforce than their parents. Papert (1993b) states despite the many manifestations of a wide spread desire for change**,** the education establishment and its research communit**y,** remain largely committed to the educational philosophy of the 19th and 20th Century on how children are taught. So far those hallowed traditions have remained unchanged even though many have tried to loosen this grip (Papert, 1993a, p. 3). Papert (1993) believes "children can learn to use computers in a meaningful way and learning can change the way they learn everything else". He goes on to state "as long as schools confine the technology to simply improving what they are doing rather than really changing the system, nothing very significant will happen" (Papert, 1997).

2.4 A Global Context

In 2002 the United States (US) introduced the 'No Child Left Behind Act' (NCLB). This Federal legislation enacted the theory of standards, based on education reform, which centred on the belief that setting high standards and establishing measurable goals can improve individual outcomes in education. As part of this the 'Enhancing Education through Technology Act of 2001' was implemented (US Department of Education, 2010). The aim of this act was to provide assistance to state and local authorities for the implementation and support of comprehensive systems that use ICT effectively to improve student's academic achievements. Along with promoting initiatives that provide teachers, principals and administrators with the capacity to integrate technology effectively into teaching and learning through a higher quality professional learning program.

The situation in Singapore, in regard to the development of ICT in education, is different to that of the U.S. Singapore is a country which places a huge importance on its human capital development and with this in mind the government implemented 'Singapore's ICT Master-plan 1997-2008 for integrating ICT into education'. For Singapore

> *"human capital is the key competitive difference in changing the global landscape and investing in education has been the national priority right from the start, with education providing students with the core knowledge and skills and habits of learning that enable them to learn continuously throughout their lives"(Koh & Lee, 2008, p.1).*

The United Kingdom (UK) in 1997, under the leadership of Prime Minister Blair, claimed education as the number one priority. From this commitment the National Grid for Learning (NGfL) was charged with the responsibility for providing students and teachers with high-quality educational materials. The British Education Computing and Technology Authority (BECTA) was set up with the main objective being to influence the teaching direction and development of national policy to best take advantage of new technologies in education. It was established in 1998 (Wikapedia, 2010). In 2006, NGfL was amalgamated with BECTA as it was felt that

both these organisations were providing similar services and resources therefore, to save taxpayers' money, they were rolled into one. In 2010, under the current government, BECTA would no longer receive government funding and closed its doors in June (BECTA, 2010). With the announcement of its closure, BECTA initiated a government campaign to establish 'Next Generation Learning' which aims to use technology to create a more exciting, rewarding and successful experience for learners of all ages and abilities, thereby enabling everyone to achieve their potential (Next Generation Learning, 2010).

In the 1990s a few centres of leadership, in New Zealand, were successfully introducing ICT into their schools but there needed to be a coordinated vision and strategy to meet the needs of all students. Consequently, in 1998 the Ministry of Education (NZ) set out aspirations for developing the use of ICT in education and provided information on initiatives to help achieve the goals set through the Digital Horizons Strategy 2002-2004 This strategy from New Zealand (NZ) had a vision for all learners to be confident, creative users of ICT; developing the skills and knowledge needed to be full participants in the global community (Ministry of Education New Zealand, 2003). Mr Millard (2003), the Minister of Education NZ, wrote:

> *"Wonderful things are happening with ICT in our schools, and I am constantly amazed at the range and standard of work that children are producing as a result. I know we are posting better results than many systems internationally in providing a learning environment that equips young people with knowledge and skills for an on-line world and this strategy builds on our success to guide future development in a fast changing environment" (Ministry of Education New Zealand, 2003, p. 2).*

In addition to these strategies, the New Zealand Ministry of Education released the 2006-2010 action plan entitled 'Enabling the 21st learner – an e-Learning' (New Zealand Ministry of Education, 2006). This document built on the previous two documents – Interactive Education (1998) and Digital Horizons (2002). Steve Maharey (Minister of Education 2006) stated:

> *"e-Learning has the potential to transform the way we learn. ICT is about exploiting technologies and using ICT effectively across the curriculum to connect schools and communities and to support evidence based decision making and practices in schools" and goes on to say that for New Zealand, the development of a prosperous and confident knowledge society means the development of new skills and knowledge. It will require a culture of continuous enquiry, innovation and improvement, risk taking, and entrepreneurship. This can only come from the education system (New Zealand Ministry of Education, 2006\, p.5).*

The focus of *Interactive Education* (Ministry of Education, 1998) and *Digital Horizons* (Ministry of Education, 2003) were to lay foundations for the effective use of ICT in schooling by:

- providing professional development for educators;
- ensuring appropriate online learning resources were available;
- building infrastructure (networks, software, hardware, technical support, and broadband access);
- mainstreaming and integrating the role of ICT into schooling in a more strategic way.

Research from New Zealand Ministry of Education (2006) has shown these ICT strategies for schools have contributed to substantial growth in the effective use of ICT supporting learning and teaching. In particular, increasing the capability and confidence of teachers to use ICT to support student learning**,** schools have accepted ICT as an integral part of effective professional practice. However, it was found these practices are not yet fully embedded into everyday teaching practice, both within and between schools. Furthermore, changes in teaching practice are not yet systemic. The challenge is, therefore, to ensure what we know about effective teaching and learning using ICT is rapidly spread and adopted throughout the school system. Hence, the need for the next phase of the e-Learning action plans (New Zealand Ministry of Education, 2006).

The Horizon report (2010) is an annual report that has been published over the last seven years predicts the critical trends and challenges that will affect teaching and learning over the next five years. The emerging trends identified in the report were:

- technology is increasingly a means for empowering students, a method for communication and socializing, and a ubiquitous, transparent part of students' lives;
- technology continues to profoundly affect the way we work, collaborate, communicate, and succeed;
- the perceived value of innovation and creativity is increasing;
- there is increasing interest in just-in-time, alternate, or non-formal avenues of education, such as online learning, mentoring, and independent study;
- the way we think of learning environments is changing.

It goes on to identify the critical challengers that educators and policy makers will face over the same time period. There were:

- digital media literacy continues its rise in importance as a key skill in every discipline and profession;
- students are different, but educational practice and the materials that support it are changing, only slowly;
- many policy makers and educators believe that deep reform is needed, but at the same time, there is little agreement as to what a new model of education might look like;
- a key challenge is the fundamental structure of the K-12 education establishment;
- many activities related to learning and education takes place outside the walls of the classroom — but these experiences are often undervalued or unacknowledged (Education.au, 2010).

This report is important to this study because it will help consolidate the understanding of the future directions of technologies in education and guide this investigation and to whether this is in fact the case in Western Australian in the

present day and the degree to which change has occurred since the introduction of computers in WA primary schools.

2.5 Australian Context

For more than a three decades governments and school communities around Australia have been working to harness the power of information and communication technologies (ICT) to improve educational opportunities, boost outcomes and energise the learning experience for all students. Major investments have been made by state and territory governments and the Commonwealth to roll out infrastructure, develop online resources and build teacher capability. Progress to date has been impressive, but uneven. Most teachers and students now benefit in some way from access to computers and digital resources, but still only a minority are reaping the full benefits of the information technology revolution (DEEWR, 2008).

The impact of computers in Australian schools began to take shape in 1979 with the examination of social implications of new technologies in education. By the end of 1983, the majority of secondary schools in Australia had at least one computer with computers in primary schools beginning to increase (Anderson, 1984). Nevertheless, there were obvious differences between the states. Firstly South Australia was the first state to establish a computer centre in 1968, followed by Tasmania in 1975 and Western Australia in 1977. However, little if any development occurred in other states until a federal initiative in 1983. The second difference between the states was the perceived need by some states to adopt a coordinated central approach and the third point of difference was between states in adopting policies regarding computing activities in schools. Throughout the development of ICT in schools it was the smaller populated states of South Australia, Tasmania and Western Australia that were in the forefront of establishing computer in schools. However, the publication of polices does not necessarily reflect practices (Anderson, 1984). Over the past three decades successive Australian governments have attempted to prepare citizens for a changing world by ensuring they are able to access and effectively utilise new technologies (MCEETYA, 2001). Nonetheless, according to research conducted by Lee (2009) Australia, as a nation, lags behind many of its international competitors

due to the inactivity of past governments. The federal government under Rudd's leadership was seeking to make up for lost ground with its 'digital education revolution', however even with this intervention Australia is at least a decade behind other countries like New Zealand, the United Kingdom and Singapore (Lee, 2009).

In 1989, the Australian Federal government and the Ministers of Education for each State and Territory met and agreed that the education of Australia's children were the foundation on which to build our future as a nation (MCEECDYA, 2010a). The historic agreement and commitment to act jointly to assist Australian schools in meeting the challenges of our world lead to the development of the Hobart Declaration (1989). This document was superseded in 1999 by the Adelaide Declaration on the National Goals of Schooling in the Twenty First Century and which in turn has been superseded by the Melbourne Declaration on the National Goals of Schooling for the Twenty First Century in 2008 (MCEECDYA, 2010a).

In 1999 Ken Boston addressed the curriculum Corporation's 6th National conference stating:

> "*in the Australian school sector, no single state or territory has by itself the cultural, technical or economic power to trade in the global environment of digital technology, and at the same time maintain an Australian identity to ICT educational product (including curriculum knowledge and delivery").*

Furthermore, he argues the lack of innovation and Australian context available to educators online is limited and believes Australia is strongly reliant on what comes out of America. He cautions;

> *the "revolutionary learning promised by the Internet would have a long lead time, that we faced a massive job in training and development; that it is a world of difference between technology being available to all and being able or wanting to use it for productive gains; that it is not simply a matter of money but also of motivation, and that the Internet would*

> *complement rather than replace the moral and intellectual authority of the teacher" (Boston, 1999).*

Boston concluded his key-note address by stating it is within our reach to ensure the confluence of the new thinking about teaching and learning made possible by digital technologies, innovative experiments across the nation by teachers and schools, and a strong support of industry and governments will enable digital teaching and learning to be harnessed to reform Australian education so it responds to the needs of our time and continent (Boston, 1999).

The Australian Ministers of Education recognise rapid and continuing advances ICT are:

> *"changing the way we share, use, develop and process information and technology, and there has been a massive shift in power – to consumers in general, and to learners specifically. In this digital age, young people generally need to be highly literate in ICT and increasingly expect to be able to use such technologies in their learning. While there is some knowledge about how to effectively embed these technologies in learning in schools, we need to make a quantum leap in this effectiveness over the next decade" (MCEETYA, 2008a).*

The national goals stated The Adelaide Declaration (1999) provided a basis for investing in schooling to enable all young people to engage effectively with an increasingly complex world. A world characterised by advances in information and communication technologies, population diversity arising from international mobility and migration, and complex environmental and social challenges.

The Melbourne Declaration on Educational Goals for Young Australians (2008) stated "in this digital age young people need to be highly skilled in the use of ICT" (MCEETYA, 2008b). This assertion continued a theme from the earlier Adelaide Declaration of Australia's National Goals for Schooling (1999) which sited when students left school they should be "confident, creative and productive users of new

technologies, particularly information and communication technologies, and understand the impact of those technologies on society" .

Over the years MCEETYA has released a myriad of documents in relation to ICT integration into teaching and learning. More recently reports have focused on pedagogical and leadership strategies namely learning in an online world series which looks at topics such as contemporary learning (2005), content, leadership and pedagogy strategies (2006) and learning space frameworks (2008). Some of these documents will be discussed in more detail throughout this literature review. In 2005 and again in 2008 MCEETYA conducted the National Assessment Program (NAP) - ICT literacy for years 6 and 10. In April 2010 a report presenting the findings from the 2008 assessment cycle was released. The NAP for ICT literacy assessed students in Years 6 and 10 on their levels of confidence, creativity and skills development in the use of ICT technologies. The committee found:

> *"many students use ICT in a relatively limited way and this is reflected in their overall level of ICT literacy. There are differences associated with socioeconomic background, Indigenous status and remote geographic locations that deserve attention" (MCEECDYA,2010b).*

Other states have put initiatives in place to address the growing demands of students and parents to address the need for an education system that embraces ICT. The Queensland Department of Education and Training established the Smart Classroom strategy (2002) as a means of helping teachers and administrators use ICT and the Internet as a natural part of teaching and learning. This strategy united State Government investment with innovation in schools (http://eduaction.qld.gov.au). As part of the Smart Classroom's strategy a framework to guide professional learning to help teachers embrace digital pedagogy was developed. This framework emphasises good pedagogy that achieved the outcomes to meet the needs of today's students through the harnessing of a range of technologies to enhance pedagogical practice (http://eduaction.qld.gov.au). This framework consists of three levels these being: Level 1 ICT certificate which outlines a foundation level of ICT use for teachers in the 21st Century. The second level is the digital pedagogy licence and this

acknowledges teachers who effectively embrace digital pedagogy, whilst the third level of digital pedagogy licence advance acknowledges teachers who embrace digital pedagogy and demonstrate leadership of this with schools. This framework has been aligned with the school ICT index, Queensland professional standards for teachers and the National framework for professional standards for teachers (Queensland Department of Education & Training, 2011).

In Victoria the push to integrate ICT into their state schools began in 1995 with the formulation of the Classrooms of the Future project. As part of this project the Navigator schools were established with the aim of creating a network of exemplar schools with accessible models of new learning environments that enabled other schools across the state to emulate. These schools were also developed to provide premium professional development resources for teachers and principals to access (Jordan, 2010).

In South Australia the Department of Education and Children's Services developed the Technology & Knowledge Management Service with the responsibility for developing strategy, setting policy and defining outcomes for various ICT infrastructures. The Computers in Education & Computers Recycling Scheme program was established to improve the ratio of computers to users on schools and preschools and they instigated the Profession Learning in ICT (PLICT) project developing a competency framework and EdCap Survey tool to monitor ICT implementation in schools across South Australia (Department of Education & Children's Services, 2006).

Since 2007, under a Labor Government, Australian schools and education systems have been part of the Digital Revolution strategy. This strategy aims to "contribute sustainable and meaningful change to teaching and learning in Australian schools that will prepare students for further education, training and to live and work in a digital world" (Australian Government, 2010).

In 2010 Australia's national educational goals placed considerable importance on the role of ICT in education through the collaboration of state education ministers in the formulation of the National (Australian) Curriculum. In this document it states…

> *Education plays a critical role in shaping the lives of the nation's future citizens. To play this role effectively, the intellectual, personal, social and educational needs of young Australians must be addressed at a time when ideas about the goals of education are changing and will continue to evolve.*
>
> *An Australian Curriculum in the 21st century needs to acknowledge the changing ways in which young people will learn and the challenges that will continue to shape their learning in the future. The curriculum is important in setting out what will be taught, what students need to learn and the expected quality of that learning. (ACARA, 2010)*

2.6 Western Australian Context

The Department of Education (DoE) in Western Australia under the National focus is investing in various technology initiatives to increase the knowledge and understanding of ICT in the curriculum. The introduction of technology into primary schools came about in the mid-eighties through the 'Computers in School' project as IBM became affordable and the Internet was developed. Ten years later, in 1997, the Department implemented the 'Internet in Schools' program whereby selected members of each school were trained using a 'Train the Trainer' method of professional learning. In the researcher's experience this was an effective way of training large numbers at minimal cost and disruption to the school but unless the school had visionary leadership and made budget allocations to release the teachers and the trainer then knowledge and understanding was not passed on to others.

In 1998 the 'Learning Technologies' project secured an additional eighty million dollars of funding for the next four years to increase the integration of technologies into teaching and learning (Education Department of Western Australia, 1998). As part of this funding, the 'Technology 2000' project was initiated to support schools using information technologies to improve teaching and learning. There is compelling evidence that with appropriate teaching and learning techniques, learning technologies can improve students' learning styles. The Department realised many

schools were expanding their use of computers as tools for learning in a range of learning areas. By incorporating learning technologies into the school curriculum, and developing students' IT skills schools are strategically positioning students for the workforce (Department of Education, 1997).

The Department acknowledged that implementing and managing learning technologies so they will be efficient and effective in their purpose across a school required detailed planning, leadership and co-ordinated effort; to meet this need DoE developed the Technology 2000 strategy (Department of Education, 1997).

The research on teacher change and instructional reform, in general, indicates changing teacher practice is often slow, minimal or even non-existent (Ball, 1990; Cohen, 1990). In 2002 the Department made a decision to invest in the '100 Schools' initiative to support schools in implementing ICT. Under this project 100 schools in Western Australia were selected to receive, over three years, large sums of funding to have high-speed networking facilities, upgraded computer student ratios and professional learning for staff. These schools became 'lighthouse schools' with the aim of supporting other schools in the implementation of ICT. However, teachers did not always have the opportunity to learn about and practice instructional reform. Therefore, in 2005 further funding was sought from the government to extend the program to include more schools. As research indicated, teachers were more likely to integrate ICT into their teaching and learning if they had access to adequate equipment and high-speed Internet connection. This program became known as LwICT (*Learning with Information Communication Technology).*

In Western Australia, ICT has been implemented in the public school sector with varying degrees of success. The Department of Education and Training in Western Australia had attempted to improve the integration of ICT into public schools by investing a further eight million dollars into various ICT programs. The latest being 'LwICT which was formally known as the '100 Schools' project'. The aim of this project was to improve teacher competencies in the use of ICT, both professionally

and personally, and to enhance the learning opportunities for students across government schools. Its overall strategy was to improve learning opportunities for children by utilising the latest in Information Technology.

Between 2002 and 2009 the Government provided funding for appropriate professional learning, curriculum and technology support services and, where required, the implementation of new or upgraded information and communication technologies in schools. In 2006 DoE (*Department of Education*) initiated the '*Online Teaching and Learning System*' (OTLS). This is one of the services provided through the Online Curriculum Services project and provides teachers with an online environment to plan, deliver, monitor and evaluate online and blended learning programs. Another service provided by DoE) is the '*Online Professional Learning System*' (OPL). It is the DoE's platform for delivering and managing online professional learning opportunities for staff. OPL is available to all DoE staff through the DoE portal. As part of the professional learning opportunities DoE is providing a FREE online professional learning program for teachers using SchoolKiT's pd21 program 'Teachers have Class'. This professional learning provides relevant and practical online self-paced, on demand and instructor-led courses focused on technology integration with best practices pedagogies into teaching and learning to achieve maximum outcomes for students (http://www.det.wa.edu.au/curriculumsupport/ocs/detcms/portal/).

2.7 ICT in Primary School Classroom

The ever morphing of ICT in recent years has resulted in significant changes in the way humanity interacts and communicates on a global scale. This in turn has had an impact on the educational needs of students, both in terms of content and delivery. There has been increasing pressure from all sectors of society for decision makers to acquire new technologies and to integrate these technologies into teaching and learning. Before investigating the question 'Why use ICT in primary school?' a clarification of what is meant by integrating ICT into teaching and learning needs to be established. Anderson (2005) theorises that computer integration into the

classroom is the application of technology to assist, enhance and extend student knowledge. Whilst, Jefferies (2000) argues technology integration is more than merely utilising the computer as a typewriter, calculator or film projector. He believes integration begins with solid planning by the teacher so the use of technology is meaningful and relevant to the students' educational experience. Furthermore, McKenzie (1999) states technology integration should support and not dominate solid curriculum. In sum, one concurs technology should assist the student in the quest for knowledge and understanding in a collaborative environment whereby, the teacher facilitates rather than instructs.

It is the view of this researcher there are a number of reasons for using ICT in primary school. According to Meadows and Leask (2000) these factors have been divided into five categories:

- Political;
- Personal/professional;
- Professional/student needs;
- Professional curriculum, and
- Professional/Educational theory

In addressing the question 'Why use ICT in primary schools?' one needs to return to the Australian National scene. In 1996 the Commonwealth Department of Employment, Education, Training, and Youth Affairs (DEETYA) released a report based on the National Significance Information Technology and the Learning Process. This report recognized and described the potential of Information Technology (IT), as it was known then, on the learning process. From this report three significant trends emerged. These being, an overwhelming need for learners to experience the communication media of their generation, the effect of IT use on teachers' paradigm from expert to facilitator and the motivational aspect of IT for students. Nevertheless, despite this report being released fifteen years ago much of what was reported still forms a significant part of research today.

In 1999 the State Ministers for Education joined forces and came up with the National Goals for Schooling in the 21st Century (Adelaide Declaration) which had a strong emphasis on ICT integration. Its aim was to develop in all Australians students the knowledge, understanding, skills and values they will need for a productive and rewarding life in an educational, just and open society.

The Adelaide declaration asserted that "in this digital age young people need to be highly skilled in the use of ICT" (MCEETYA 2003). This assertion continued the theme from the Adelaide Declaration of Australia's National Goals for Schooling 1999 which stated:

> *When students leave school they should be confident, creative and productive users of new technologies, in particularly information communication technologies and understand the impact of these technologies on society (MCEETYA, 2001).*

The Adelaide Declaration has since been superseded by The Melbourne Declaration of Educational Goals for Young Australians (2008), however this assertion still stands. As a result of the Adelaide Declaration (1999), the early 2000s saw a big push to get every school connected to broad band internet. During this time, the Western Australian Department of Education (DoE) fully supported the national agenda with its own strategic plan for ICT.

In 2001 DoE introduced the 'Notebook for Teachers' program, whereby teachers could enrol on a voluntary basis to receive, over a three year period, a computer complete with software, introductory training, insurance and support.

To develop school capacity to meet the growing pressure to integrate ICT into teaching and learning DoE, in conjunction with the Gallop Government, established the 100 Schools in 2002 at a cost of 20 million dollars. In this project 100 schools (primary and secondary) from approximately 560 government schools across

Western Australia were selected to receive information technology training and infrastructure to enable students to get maximum value out of computers, computer software and the Internet. The 100 Schools Project provided for:

- additional computers where required;
- funding of additional staff time in each school to support a school-based curriculum ICT Co-ordinator to support teachers using information and communication technology;
- development of professional learning support for each school's particular requirements and support for the development of a learning community both online and face-to-face;
- an extensive cabling program;
- electrical power upgrades to accommodate the new ICT equipment and infrastructure; and
- where required, installation of steel security cabinets and the upgrade of existing storerooms to protect schools' ICT equipment.

> *"The 100 Schools Project focuses on delivering benefits in the Government's educational priority areas of improving literacy and numeracy; increasing retention rates; creating better learning environments; developing better information technology; and raising the standards and status of teachers," Mr Carpenter said (Government of Western Australia, 2003).*

In 2005 the LwICT (Learning with Information and Communication Technologies) Project became an extension of the 100SP (100 Schools Project). The LWICT Project's overall strategy was to improve learning opportunities for children in Government schools across the State utilising the latest in Information Technology. The Government has provided funding for appropriate professional learning, curriculum and technology support services and, where required, the implementation of new or upgraded information and communication technologies in schools for 2002-2009. By the end of 2009, 131 primary schools across WA participated in the LwICT project and, in addition, 262 primary schools of which 123 were also part of

LwICT, participated in the Online Teaching and Learning Service (OTLS) which is now known as SOCs (Schools online Curriculum service).

Since 2006, the Department of Education and Training has been implementing the Online Curriculum Services (OCS) project to deliver online tools and services to support teachers in the provision of 21st Century learning opportunities for students. The project supports the Department's Classroom First strategy with a vision for schools becoming networked learning communities and using ICT as an integral part of teaching and learning. The aim of the OCS team is to have all schools online by the end of 2012 (Department of Education, 2010).

Figure 1 illustrates the development of the ICT service provided by DoE in WA to support and assist schools, leaders and teachers in the delivery of ICT into their teaching and learning.

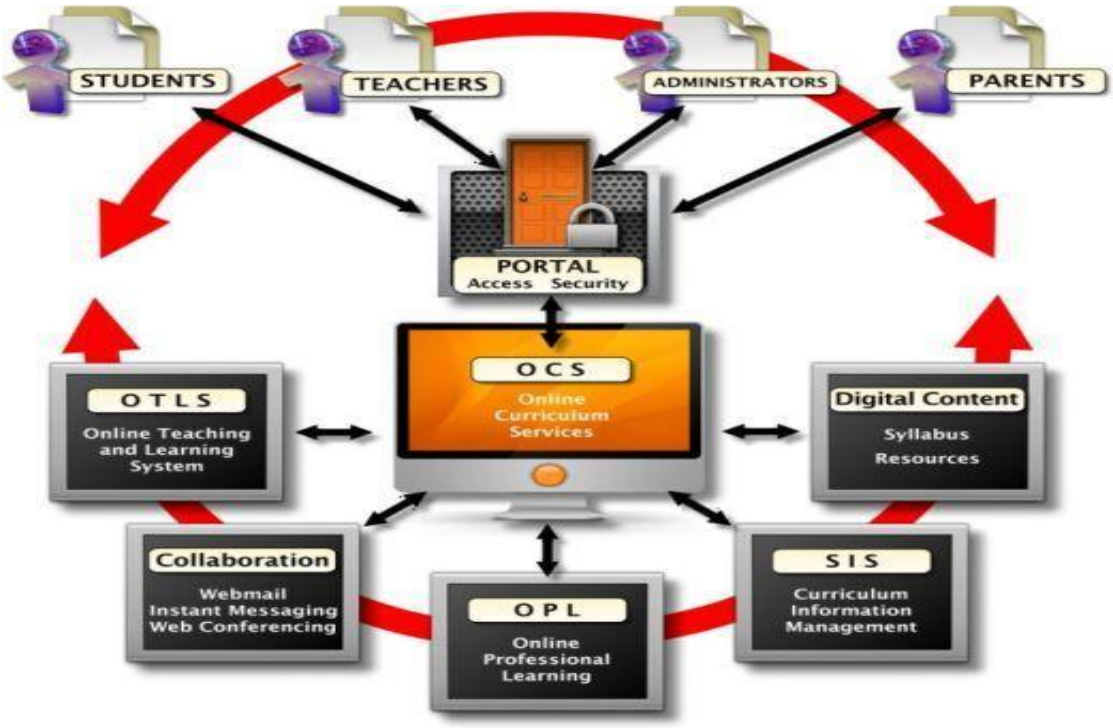

Figure 1: On line Curriculum Service Framework

This was the beginning of the many strategies to integrate ICT into the curriculum by DoE. However, evidence from the research undertaken indicates there has been very little change in ICT integration in primary schools today. ICT in primary school is still very much teacher directed, work-book related for limited periods of time and confined to learning about the machine itself or about software applications. This leads one to make the assertion that it is not from the lack of support, resources and infrastructure provided by DoE that prevents schools and teachers from integrating ICT into their teaching and learning there is more to it.

Since the mid-sixties, Seymour Papert has been writing about the power and technological sophistication of the computer and how it had the potential to transform our education system. However, within the history of education, computers represent a very recent arrival onto the educational scene and their role is yet to be fully explored (Papert, 1988). In 1988, Papert reported:

> *an examination of computer use in schools reveals that students' interactions with computers are largely teacher directed, work-book related for limited periods of time and confined to learning about the machines themselves or about the software applications.*

> *What we need is kinds of activity in the classroom where the teacher is learning at the same time as the kids and with the kids. Unless you do that you'll never get out of the bind of what the teachers can do is limited by what there were taught to do when they went to school (Papert, nd).*

The Rudd government, as part of its election platform in 2007, established the Digital Revolution setting out a direction for education. A commitment to developing a world class educational system in Australia involving the use of computers and access to reliable high speed broadband was made. The aim of which being to provide closer links between schools, teachers, students and parents and to realise the true potential of e-education. The policy stated 'it will change the way teachers teach and students learn…ICT is no longer just another subject taught in schools, it is a means of learning across all subjects. The Australian students need greater access to, and sophisticated

use of, information and communication technologies. Rudd reported "they need a digital education that prepares them for the jobs of tomorrow" (Rudd, Smith & Conroy, 2007).

Alan November, an international leader in education technology, argues "we need to tap into the potential of empowering students to have the confidence and the courage to learn without needing the formal structure of the traditional classroom" (November, 2010).

The rhetoric is one thing but the reality can be completely different. In reality the marriage between education and technology is not a happy one. It does not matter how much money is injected into these projects, research demonstrates policy makers believe that by simply equipping schools with computers and training teachers in the use of ICT will prepare students for the demands of the 21st century. But we now know that by simply providing access to ICT is not going to radically change education systems for the better. It is more than that (Vrasidas & Glass, 2005).

Educators have deliberated on how computers should be used to support learning, and what improvements in student learning could be expected. Elliott (2004) states in many ways Australia has been a leader in ICT and education since the earliest days but twenty years on teachers still have little confidence, ability or interest to integrate ICT into their teaching. MCEETYA (2001) reports the "coming knowledge based society will demand of all its members a high level of competence in dealing with information and information technology. All students must have access to adequate opportunities to develop their abilities to use computers and information networks". Meanwhile Newhouse, (2002) argues over time, as computers have become more affordable and with the introduction of the Internet, educators are becoming more focused on the use of technology to improve student learning. These factors have combined to mean investment in ICT is more prevalent.

Rogers, (2004) and McKenzie, (1999) highlight even though computers have been in schools since the early 1970s; they have failed to deliver the transformation in learning that has been promised and promoted. According to these authors, computers have never really had an impact on the teaching and learning program because of their limited numbers, lack of suitable educational software and teachers' lack of knowledge and understanding of what a powerful tool ICT can be in teaching and learning. Rogers (2004) states, "teachers simply have not embraced the computer as a basic tool of learning" and one of the reasons for this is the lack of appropriate staff development. We should consider this is nearly twenty years after the introduction of computers in schools (Rogers, 2004). Hennessy & Deaney, (2004) reported governments around the world began and continue to invest substantial amounts of money into the implementation of ICT into teaching and learning. In primary schools today, some teachers are beginning to use computers in the teaching and learning program as a tool to improve student outcomes but in many cases this technology sits idle because teachers lack the skills and knowledge to successfully implement computers within the education sphere (Kleiman, 2005; McKenzie, 2001a). Research conducted by ISTE (2007) stated schools use ICT as a tool for developing students' computer and internet skills. This is important but technology proficiency is simply the point of entry into the digital world. They confirm the research findings conducted by others such as McKenzie (2001) and Kleiman (2005) by arguing despite federal and state investment in technology and internet connectivity, most schools still use technology sparingly, rather than as a critical component of all educational operations.

One of the many pitfalls identified by researchers (Bowman, 2004; Downes, et al, 2002) into the integration of ICT into classrooms is the issue of access, confidence and competence of the teachers to use the technology. In order to overcome the issue of inadequate resourcing the Western Australian Government, along with many other governments around the world, began to increase the funding available for technology integration (Education Review Office, 2001; EDWA, 1997; Eisenberg & Johnson 2002; Kleiman, 2005; Ofsted, 2001).

In 1998 the Department of Education (DoE) of Western Australia invested twenty million dollars in the 'Computers in Classroom' project to assist schools to increase the number of computers in the classroom with an additional eighty million dollars secured for the next four years to support learning technology projects (Education Department of Western Australia, 1998). The monies allocated were specifically for the acquisition of hardware and connectivity. Since 1998, millions more dollars have been invested in a range of projects to meet the needs of the global community in educating and preparing students for the future.

Governments across Australia have acknowledged the importance of ICT in knowledge development by endorsing the National Goals for Schooling in the 21st Century (Adelaide Declaration) in April, 1999. A number of the Department's initiatives have been implemented with the aim of increasing access to ICT in response to the growing demand on teachers to apply ICT into their teaching and learning programs in ways that will enhance the learning outcomes of students.

According to research conducted by ISTE (2007) to help student achieve proficiency in 21st Century skills, teachers and administrators need education support systems that strengthen their instructional, leadership and management capacity. Therefore both students and educators need learning environments that are conducive to results.

The partnership for 21st Century skills has emerged as a leading advocacy for infusing 21st Century skills into education and this collaborative group has designed a framework that describes the relationship between content, support, skills and learning (Schrum, & Levin, 2009). This framework (figure 2) represents in a visual format how some researchers (www.21stcenturyskills.org) see how technology becomes an integral part of 21st Century learning.

In figure 2 the rainbow represents student outcomes including skills, knowledge and expertise students should master to succeed in work and life in the 21st Century and

beyond. In addition to the rainbow (core subjects and 21st century themes, learning and innovation skills, informational, media and technology skills and life and career skills) underpinning and essential to the success of these elements are the 21st Century support systems of standards and assessment, curriculum and instruction, professional learning and learning environments.

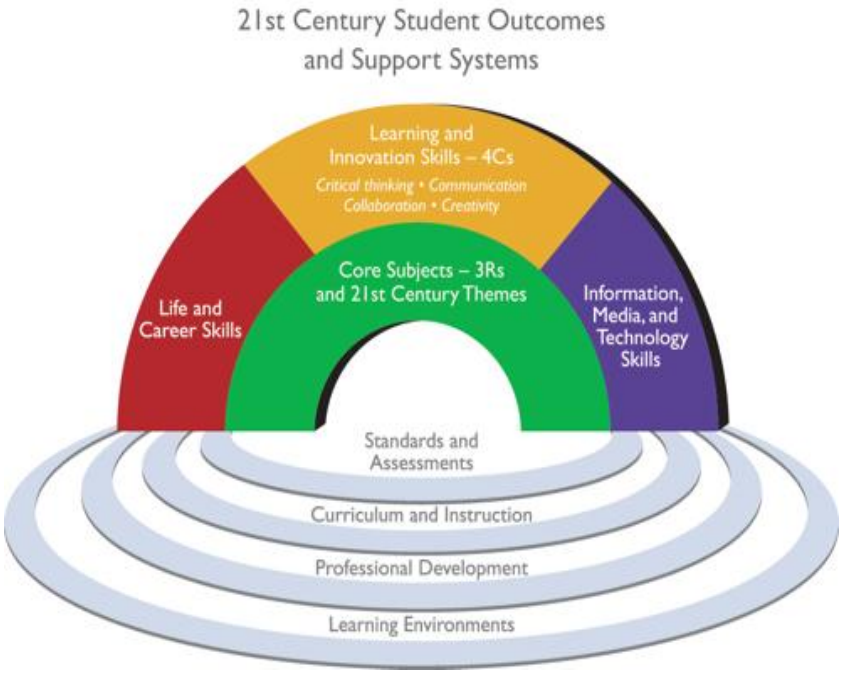

Figure 2: The partnership for 21st Century skills by Schrum & Levin, 2009, Leading 21st Century schools: Harnessing the technology for engagement and achievement. Copyright by Corwin 2009

A report from the officer of the Auditor General (2001) indicated over 95% of the teachers interviewed reported having more than the basic ICT operational skills. However, the majority of teachers were not confident about applying ICT to facilitate student learning (Pearson, 2001). These outcomes were consistent with the teachers self-reports collected by Department of Education WA (DoE) (Education Department of WA, 1998). As a result of these reports, DoE put forward many initiatives to improve teacher confidence and competence in integrating ICT into teaching and learning through the implementation of the Technology 2000 strategic plan (EDWA, 1998). For example, as part of the 'Curriculum through ICT' program and 'Partners in Learning' (2007), the Department set up access to:

- ‘Teachers have Class’ an online professional learning program for all teachers and interested Education Assistants;
- the notebook for teachers program;
- the 100 schools/LwICT as part of the ‘e2c’ strategy;
- ‘School Online Curriculum Service’ (SOCS) project

(Department of Education and Training, 2006).

2.8 Pedagogical Justification for Investing in ICT in Primary Schools

Few educational topics can spark a heated debate amongst educators like the conversation of integrating ICT into teaching and learning in the primary classroom (Ellis, 1988; Kennewell, et al. 2000; Loveless & Ellis, 2001; Cubin, 2001; Carr, 2010). Sivin-Kachala & Bialo (2001) stated “technology can improve teaching and learning, but just having technology does not automatically translate to better outcomes”.

As a society we are reliant on technology therefore schools need to prepare students who are competent in its use. One way to do this is to ensure technology is effectively integrated into the curriculum and becomes a part of the teaching and learning pedagogy (Jeffries, 2000). According to November (2010) technology can be a powerful motivator for students who do not succeed in a traditional classroom. It enables the power of control to shift so the learner can manage his/her own learning by providing instant feedback which enables the student to stay focused, take pride in his/her effort and work through problems.

ICT has the potential of empowering students to have the confidence and courage to learn without the need for formal structures. However, adding technology to the classroom is relatively easy; it is more difficult to reshape the relationship between the teacher and student by transforming the shift of control from the school system to the learner (Leask & Meadow, 2000; Lee & Gaffney, 2009; Loveless & Ellis, 2001; November, 2010).

It has long been recognised by many educational leaders and researchers (Kleiman, 2005; Loveless, DeVoogd & Bohlin 2001; McKenzie, 1997, 1998, 1999a, 2004; Seaton, 2002) that teachers, schools and systems are having difficulty coming to terms with some of the contradictions between key learning principles and practices on the one hand and the pressure of accountability and traditional school culture on the other (Seaton, 2002).

Traditional pedagogical approaches emphasised the teacher as knowledge broker, the student as receiver of knowledge and the work being about content mastery. With the new pedagogy, sometimes referred to as critical pedagogy, all social constructivism, emphasises the student as learner in the social context and knowledge as the product within the social context (Travers & Decker, 1999). Trinidad (2005, p. 1) asserts the:

> *integration of ICT into classrooms enables teachers to shift their pedagogical approach toward a balance between teacher-centred instruction and learner-centred environments that involve collaborative problem solving and critical thinking.*

The Apple Classroom of Tomorrow (ACOT, 1995) project in the US reported "what happened in the classroom is largely the responsibility of the teacher and more or better technology isn't enough" (ACOT, 2008). Haberman (1995) agrees "no school can be better than its teachers and argues that teachers need to know what they are doing and why they do it". Furthermore, Fisher, Dwyer & Yocam (1996) concluded that the problems holding back the use of technology in education is social not technical. Furthermore, the technology they use is not neutral and nor is their pedagogy therefore well-grounded teachers are positioned to make the most of the new technologies.

According to Fisher, et al. (1996) "classroom innovators are often teachers who have a strong belief about how children learn, passionate about teaching and have some understanding about how technology can help learners to do things better or

differently". Whilst Trinidad (2005) maintains there needs to be emphasis on constructing a leaning-centred environment based on leaning with technology rather than teaching with technology.

To enable teachers to make a shift from traditional pedagogy to a more critical or constructive pedagogy they need to understand how to set the stage, monitor and engage participation by forming cooperative groups that assign roles and responsibilities and how to monitor and assess performance (Harasim, Starr, Telex & Turnoff, 1996). Barrett (1999 as cited in Seaton, 2002 p. 10), suggests research is finding students between the ages of 10 and 15 are 'switching off' and they need to have opportunities to negotiate learning which is useful now as well as in the future. Seaton (2002) states a "coherent curriculum is focused on the identified needs, interests and concerns of students along with the emphasis on self-directed and constructive learning". Furthermore, Seaton believes primary schools have a long way to go in terms of providing students with opportunities to construct understandings as they use and analyse text in real context for personal and social purposes. He continues by stating "teachers in a work-oriented classroom concern themselves with information transmission focusing on mastery of predetermined outcomes, whereas in a learning-oriented classroom the teacher facilitates the construction of knowledge through an emphasis on problem solving and open ended activities that are connected to student values, interest, purpose and life worlds" (Seaton, 2002, p. 13). Whilst Murcia & McKenzie (2008) believe that technology is an integral part of social practice and those who do not have meaningful access to technology are clearly disadvantaged. Weston & Bain (2010) argue in other fields such as surgery, designing and forecasting, form and function of usage have driven access to technology and not the other way around. They cite educators should think similarly because the mere existence of new technologies will not transform teaching and learning.

Mueller, Wood, Willoughby, Ross, & Specht (2008) suggest it may not be the technology itself that has an impact on student learning but the teachers who are willing to integrate technology by using effective practice, gathering data and

evaluating practices to improve student learning or outcomes. It has been proposed by many leaders in education and research, for example Papert (1993 & 1996), Atkin (1997), McKenzie (2003), Lee & Gaffney, (2009) and November (2010), that the use of ICT as a tool can and will assist teachers and students to become engaged in learning and have a higher level of self-direction.

Governments are investing huge dollars in introducing ICT into education to promote this philosophy of making learning more student-centred, collaborative and to encourage cooperative, creative problem solving (Kimber & Deighton, 1999). However, as in the words of Sivin-Kachala & Bialo (2001) "technology can improve teaching and learning, but having technology doesn't automatically translate to better instructional outcomes". Higgins (2003) concurs "there is evidence that ICT can help students learn and teachers teach, however, simply having more computers does not make a difference".

Gipson, (2003) believes the adoption of ICT in society is demanding schools produce graduates who are literate in the requirements of the workplace and the conduct of daily affairs. Students of today live in a digital world where computers are the norm. International, national and local research is showing schools need to keep pace with society if they are going to engage students in independent lifelong learning (Gibson, 2003; Prensky, 2005; November, 2010). It is imperative, therefore, for schools to keep pace with the ever-changing demands on society then they need to look at the way in which they deliver education.

As we move from the industrial era to the knowledge era, the technology revolution, specifically in the form of computers and Internet, has become a major focus of educational policy and reform in recent years (Prensky 2005; Lee & Winzenried, 2009). Governments around the world have invested heavily to provide schools with computer hardware, software and the necessary infrastructure to allow schools to connect to the Internet (Trinidad, 2005).

In addition this has resulted in the need to provide technology focused professional opportunities for teachers (Gipson, 2003; Smerdon, et al., 2000). Prensky (2005) posits in the digital age it is important to have new curricula and implement the use of ICT in schools because even though access to the new technologies has been provided this technology still faces a great deal of resistance as many teachers struggle to identifying and providing opportunities for students to develop the technological knowledge and skills needed for the 21st century.

2.8.1 Curriculum Reform

Coinciding with the introduction of the Curriculum Framework in 1998, curriculum reform has accelerated the push toward educational reform to support a more student-centred outcomes-focused approach that is clearly well aligned with internationally accepted understanding of learning and the needs of modern society. The introduction of outcomes based learning has encouraged the resurgence in alternative pedagogy and a move back to constructivism whereby the teacher is a facilitator of learning and not the 'sage on the stage' as in the traditional teaching role. These changes should promote better use of ICT to enhance learning and teaching processes when they are effectively implemented in schools (Newhouse, 2002).

Governments across Australia acknowledged the importance of ICT in knowledge development by endorsing the National Goals for Schooling in the 21st Century in April, 1999. The Department of Education in Western Australia had recognised the need to integrate technology into teaching and learning in government schools and was allocated state government funding to undertake the learning technologies project for government schools in 1998. The underlying aim for integrating and improving the use of ICT by students was guided by the assumption teachers themselves were confident and competent in their use of ICT in teaching and learning (Department of Education and Training, 2006).

Advocates for ICT in classrooms believe, when ICT is integrated into the teaching and learning program, it revolutionises the learning process and enhances learning outcomes (Martinez, 2010; McKenzie 2003, 2004; November, 2010; Trinidad, 2005). These authors believe teachers who recognise and value the use of ICT in the curriculum change the way they teach and consequently students become engaged in lifelong learning processes; taking responsibility for their own learning (Martinez, 2010; November, 2010; Trinidad, 2005). However, Cuban, Kirkpatrick & Peck (2001) are opponents who believes technology has had limited impact in supporting new forms of teaching and learning since their studies found four out of every ten teachers did not use technologies for instruction even though computers were readily available.

Educators have argued about how ICT should be used to support learning and what improvements in student learning could be expected. Elliott (2004) believes in many ways Australia has been a leader in ICT since the early stages of introducing computers into schools, however after twenty years teachers still have little confidence of the ability or interest in integrating ICT into their teaching and learning programs (Elliott, 2004). Newhouse (2002) suggests it is largely at the school and individual teacher level that changes may be required. However, any change should be directed toward improving the educational opportunities for all students and not just to make use of ICT. The focus must always be on improving outcomes for students and not on how the technology is used.

Although, researchers (Buckingham, 2007; Cuban et al, 2001; McKenzie 1999; Rogers, 2004) highlighted that even though computers (ICT) have been in schools since the early 1970s this technology has failed to deliver the transformation in learning that has been promised and promoted. They believe computers have never really had an impact on the teaching and learning programs because of the limited numbers, lack of suitable educational software and teachers' lack of knowledge and understanding of what a powerful tool ICT can be in teaching and learning. Rogers (2004) believes teachers simply have not embraced computers as a basic tool of learning and contributes this to the lack of appropriate staff development.

Teacher quality is a critical factor to achieving quality learning outcomes for students (Jamieson-Proctor, Finger & Albion, 2010, Ertmer, 2000) and the DER roadmap (AICTEC, 2009 p. 6) lists six principles including the principle that "education requires the pedagogical knowledge, confidence, skills, resources and support to creatively and effectively use online tools and systems to engage students". The Technological Pedagogical Content Knowledge (TPCK) was introduced to the educational research field as a theoretical framework for understanding teacher knowledge required for effective technology integration (Mishra & Koehler, 2006; Jamieson-Proctor, Finger & Albion, 2010)

Figure 2 presents a model advocated by some researchers (Mishra & Koehler, 2006) as an essential way to ensure all aspects of technology integration are addressed.

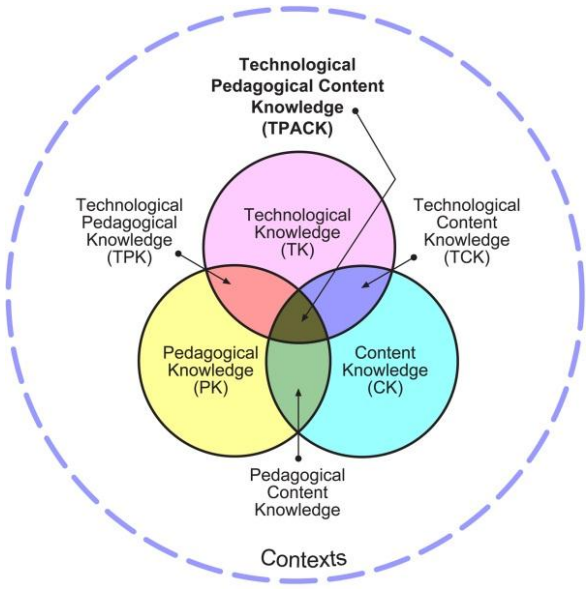

Figure 2*:* TPCK model for promoting effective teaching and learning with ICT

Mishra & Koehler (2006) believe the TPCK framework is useful for thinking about what knowledge teachers must have to integrate technology into their teaching and learning and how they might develop this knowledge. They argue the framework is a useful tool to measure teacher knowledge and could impact on the type of professional learning experiences that may be needed for teachers to effectively

integrate technology into their teaching and learning practices. Prestridge (2010) argues "ICT can no longer be made to conform to requirements of the classroom rather ICT should enable teachers' to transform their practice and ICT professional learning is seen as a vehicle to enable transformative change".

This aspect of the literature review enables the researcher to gain an understanding of how teachers and leaders develop and apply technological pedagogical content knowledge throughout their teaching instructions.

2.8.2 Professional Learning

With the investment by governments into ICT initiatives, has come the renewed push towards meaningful professional learning for teachers rather than the current practice of one off – off site professional learning (Ertmer, 2005). However, research is showing that the uptake of ICT integration into the curriculum and classrooms across the education sector throughout the world has been slow and in some cases not existent.

The evidence is increasing that educators can make significant improvements in student outcomes with the appropriate use of ICT. In the midst of substantial investments being made in ICT for schools, there is personal accountability by schools as to how effective the investment has been and where further investment should be made to maximise the impact of ICT on learning. For teachers to learn how to integrate technology into their programs, like all other learners, need to be engaged, understand the objectives of their learning, and participate in meaningful activities (Kolodny-Cole, 2003).

There is compelling evidence that with appropriate teaching and learning techniques, learning technologies can improve student learning style. The Department realised many schools are currently expanding their use of computers as tools for learning in a range of learning areas. By incorporating learning technologies into the school

curriculum, and developing the student's IT skills, will strategically position and ready students for their introduction into the workforce (Department of Education, 1997). The Department acknowledged that implementing and managing learning technologies so they will be efficient and effective in their purpose across a school required detailed planning, leadership and co-ordinated effort; to meet this need DoE developed the Technology 2000 strategy. In general the research on teacher change and instructional reform indicates changing teacher practice is often slow, minimal, or even non-existent (Ball, 1990; Cohen, 1990).

Research indicated teachers are more likely to integrate ICT into their teaching and learning if they have access to adequate equipment and high-speed Internet connection.

2.8.3 Leadership

School and district leaders have vast experience in developing pedagogy, setting standards and telling teachers how to teach. However, when it comes to instructing teachers on technology integration, educational leaders are not always in a position to demonstrate best practice (Kolondy-Cole, 2003; Lee, 2009; Fullan, 2008). As a profession, educators have an obligation to ensure the students in their care receive the best possible education available. To do this they need to break away from the 1780s model of one classroom one teacher delivering the information and embrace the notion of learning as a life long journey and that people learn in many different ways through many different avenues. The effective use of ICT as a tool is one way to make this happen. It has been well documented that ICT can and does motivate students to want to learn and it can assist the teacher to present information in a more up-to date and stimulating manner that engages all students. ICT makes the curriculum truly inclusive if used in an appropriate way and not as a glorified word processor or baby sitter (Leask & Meadows, 2001).

However, despite the pressure to go digital there are still many times when paper may play a superior role in supporting student investigations and problem solving

(McKenzie, 2001). Educators need to keep an open mind about the changes happening around them and to embrace these changes because students of today live in a different world to the one we grew up in. Educators and policy makers need to realise that today's students are the products of the digital world and the curriculum they need to be immersed in, is currently not what is on offer.

The essential message is that even though ICT has the potential to improve education considerably this in reality is not the practice and the investment level that is currently being provided cannot be sustained without there being a significant enrichment to the educational outcomes for students. At present most teachers are essentially teaching old knowledge with new technologies as the curriculum has fundamentally remained unchanged (Monteith, 2004).

2.9 Empowerment of Teacher's Skills

Research by Atkin, (1997); Baylor & Ritchie (2002); Ertmer, Addison, Lane, Ross & Woods, (1999); McKenzie, (1999) has demonstrated there are many reasons for failure to fully utilise ICT in educational institutions. These authors believe there are gaps between the rhetoric, policy and practice. However, over the past thirty years there has also been debate about access, cost, training and quality of computers (Elliot, 2004; Ertmer, 1999). Elliott suggests most schools would say they do not have enough computers, that their teachers need more training to use them more effectively and students have more ICT expertise than many teachers. It would seem that a fundamental stumbling block is in the area of teacher expertise. However, according to November (2000) 'integrating technology into existing curriculum may be an awkward and perhaps misguided retrofit. Although student outcomes may experience technologically enhanced improvements, it is still only occurring within existing frameworks and within the parameters of existing pedagogies (November, 2000).

It remains the case that many teachers still have little confidence with technology and lack either the ability or interest, or both, to integrate ICT into their teaching, even

though, according to Elliot, Australia has been a leader in ICT and education since the early 1980s (Elliot, 2004). In addition, Elliot mentions policy statements from the 1980s which proclaim ICT as the tool to change classrooms and empower students' learning. However, in reality few classrooms in the 1980s differed in any way from those of the 1970s or today. Elliott argues there are many computers in various configurations in the schools but teachers are grappling to understand their use, let alone using them for 'just in time learning' or to enhance higher order thinking and problem solving skills? Hence, despite the huge investment in ICT by governments it is difficult to gauge the extent of ICT usage in schools. In sum, it would seem that teachers still need to be furnished with skills to implement the changes outlined in the policies. Educators and policy makers understand that effective teaching for all students depends on teachers becoming confident users of new technologies and understanding how to actively integrate necessary skills into their teaching and learning opportunities. "It is the teacher's strategic use of instruction that will make a difference to the learning outcomes of students. Therefore, with knowledge and understanding teachers can transform their teaching role through the considered use of new technologies" (New Zealand Ministry of Education, 2006).

ICT policy in education needs to support schools to enable them to increase innovation and cultural change, so that teachers can transform ways students learn in an emerging knowledge society (New Zealand Ministry of Education, 2006). One of the defining characteristics of new technology is accessibility. It was found that schools should be connected to the Internet but speed, capacity and reliability are variable. Furthermore, being connected does not mean students have ready access to technologies and although schools have scanners and digital cameras, these are not always available for classroom use (Fluck, 2003; John, 2004; McKenzie, 1998).

Another major issue identified was that few schools have wireless capabilities, which therefore restricts flexibility (Elliot, 2004; Ertmer, 1999). McKenzie (1998) found too much attention had been devoted to wires and cabling, as if the mere act of networking would create a technology rich school. Instead, ICT lacked clear purpose

and undermined the purpose of good teachers, restricted the use of equipment and frustrated the efforts of technology pioneers (McKenzie, 1998). Elliott (2004) agrees with McKenzie in stating schools rushed into ICT implementation without careful thought to planning.

While many educators see computers as enriching education, Elliott (2004) questions their use and benefits. On the other hand Gipson (2003) posits there is evidence from research that ICT can help pupils to learn and teachers to teach more effectively but agrees with Elliott in that although schools continue to invest huge sums of money into ICT they receive little demonstrable returns in improved student outcomes (p. 5 & 6). McKenzie (1998) and Gipson (2003) share the view that having more computers does not make the difference. Bowman, (2004) agrees by stating although computers have been around since the early 1980s teachers still do not know how to use them for basic functions, not to mention how to use them to enhance teaching and learning. He suggests there are other factors to be considered and indeed it is the way this equipment and these resources are used by pupils and the teachers which make a difference. He believes technology should not be used to the exclusion of other options to improve pupils' attainment. Simply providing ICT equipment to schools or teachers will not effect change. Teachers need to question how students can learn the concepts central to the field of study better through the use of technology (Bowman, 2004).

With the increased influence of research comes the push for the use of ICT in teaching and learning but, as stated by Bowman (2004, p. 3) "technology is not always appropriate and there is no replacement for quality teaching governed by effective pedagogy". Any move to further the use of ICT in educational contexts should be underpinned by appropriate pedagogical and administrative principles. According to Newhouse, (2002) there are three clear rationales for the effective implementation of ICT in schools. To:

- improve student achievement of learning outcomes across the curriculum;
- provide students with adequate ICT literacy, and

- increase the efficiency and effectiveness of schools as organizations.

From a financial point of view, the successful implementation of ICT in schools involves a substantial investment and because of this, the community requires the school to be accountable for its expenditure (Gipson, 2003; Ofsted, 2004; Pearson, 2001; Smerdon, et al. 2000).

> *"New technology within the delivery of the curriculum and within the organisation, leadership and management of schools is leading a number of radical changes in the way in which education is organised and delivered" (Richardson, 2001).*

Fullan (2001) believes for any new innovation to be successful there needs to be a change in the current perception of school organisation and management. This is not only a change in the way schools are run but also in how schools are organised, and the way in which teachers deliver the curriculum in the classroom. Meanwhile, Cox et al. (2003) and Pflaum (2004) posit the key to successful implementation of ICT in teaching and learning requires a strong need for national leadership to enhance the effectiveness of ICT in schools, and to ensure the use of ICT is underpinned by a strong pedagogical foundation. They believe there needs to be adequate finances to maintain and replace aging resources and provide quality ongoing professional development.

According to Kolodny-Cole (2003), school leaders have vast experiences in developing pedagogy, setting standards and telling teachers how to teach but when it comes to technology integration they do not always practice what they preach. She believes that for teachers to learn how to integrate technology into their program they need to be engaged, understand the objectives of their learning and participate in meaningful ICT related activities.

Kolodny-Cole (2003) and Cox et al. (2003) along with others (McKenzie, 1991; Ertmer, 1999) concur that teacher professional development courses which lack pedagogical aspects are one-off experiences and are less likely to be successful. For pedagogy and curriculum delivery, teachers need to know and understand the philosophy for using ICT in teaching and learning. They also think teacher beliefs and attitudes towards change play an important part in the adoption of technology in their teaching and learning.

Pflaum (2004) states technology is a tool and, as such, in the hands of an experienced teacher, can work wonders. He says the teacher is essential, and without a teacher's understanding and involvement it does not work. McKenzie (1999) advocates teachers need to have access to appropriate ICT resources and that it is not the amount of resources that affects the use of ICT in schools, but how it is organised. Resources should be arranged in such a way that ensures maximum access for all. He (McKenzie) also believes teachers who have little or no confidence or willingness to use computers in their work will try to avoid them altogether.

In 1999 McKenzie wrote "schools have become the target for an unprecedented technology binge that is too often about decoration and status rather than achievement". He advocates for a change in the classroom from the 'sage on the stage' traditional model to include the 'guide on the side' student-centred strategies and activities. This requires a prolonged commitment to professional learning. He also suggests we need to remove the focus from IT (Information Technology) to that of IL (Information Literacy). This is about developing understanding and insight and interpreting information to guide decisions, solve problems and steer through uncertain complex futures. This is in contrast to what is currently the case of what he calls 'info glut' and 'data smog' which can interfere with learning and understanding (McKenzie, 1999).

Fung (2001) in his key-note address at the 1st *Southeast Asian Ministers of Education Organization* (SEAMEO) Educational Conference suggested a major obstacle in

school reform was the lack of time on the teachers' part. He stated teachers needed time to become familiar with the hardware, to plan and experiment with various software applications and online or multimedia content to be used within the classroom. Prensky (2005) supports Fung's view and argues if we ever want to move on with the integration of technologies into teaching and learning then it is critical for educators to learn to listen, to observe, to ask and to try all the new methods their students have already figured out.

2.9.1 Professional Learning

According to Mueller et al. (2008), some researchers suggest more professional learning on how to effectively integrate new technologies into teaching and learning is needed to move educators' forward. Hayes and Noonan (2009) believe that teachers who have a positive effect on student learning are those teachers who finely tune their programs in an effort to accommodate individual learning styles and interests. Therefore, with the investment by governments into ICT initiatives, has come the renewed push towards meaningful professional learning for teachers and not the current practice of one-off, off site professional learning. Mueller, et al. (2008) puts forward a professional learning model that incorporates both the context of teaching and the opportunity for reflection.

Although the evidence is indicating teachers can make significant improvements in student outcomes with the appropriate use of ICT, research is showing that the uptake of ICT integration into the curriculum and classrooms across the education sector throughout the world has been slow and in some cases not existent (Kleiman, 2004). In the midst of substantial investments being made in ICT for schools there is personal accountability toward how effective the investment has been and where further investment should be made to maximise the impact of ICT on learning. School and district leaders have vast experience in developing pedagogy, setting standards and telling teachers how to teach. However, when it comes to instructing teachers on technology integration, educational institutions aren't always practicing what they preach (Kolodny-Cole, 2003; Lee & Gaffney, 2009). For teachers to learn

how to integrate technology into their programs they, like all other learners, need to be engaged, understand the objectives of their learning, and participate in meaningful activities (Kolodny-Cole, 2003). Halford (2009) advocates principals should be closely involved in the design and delivery of their school's professional learning. Whist Fullan (2008, p. 37) states that "successful professional development is likely to occur in schools and classroom settings, rather than off-site". With this in mind it is important to note that any successful implementation of an innovation and ICT integration in teaching and learning is no exception, that the principal plays an important role in supporting learning, growth and development.

It is clear from the literate that ICT professional learning of teachers is critical to their role as change agents or adopters of this innovation. Teachers may feel that they have responsibilities to prepare students for their future however the literature begins to qualify the amount of PD teachers need to integrate ICT effectively into teaching and learning and make an evaluation of its full educational potential.

2.10 Pedagogical Change

The pathway to successful pedagogical transformation is diverse and the effective use of new technologies requires developing and sustaining a school culture whereby people work together to improve outcomes for students. To enable this to happen proactive leadership, planning, effective professional development, adequate financial and technical and needs to be fundamental to any pedagogical transformation (Sweeney, 2010). Fullan (2011) argues that for whole system reform the right drivers have the best change of driving successful reform. In his opinion one of these 'right drivers' is pedagogy. In his view pedagogy must come first before the technology.

2.10.1 Leadership

There is extensive literature on the degree to which leadership impacts on student learning outcomes; however even though there are diverse viewpoints

there is common agreement that leaders do make a difference (Jackson & Bezzina, 2010). School administrators play a key role in providing leadership for improvement at the school level and Halford (2009) states that school leaders have to be exemplary at modelling the behaviours and practices that are valued. He believes that principals must be able to 'walk the talk'. In an attempt to provide such leadership, school administrators need to shift their focus from that of a manager to that of an instructional leader. An effective instructional leader requires the administrator to be involved with issues of curriculum and classroom instructional practices. Fullan (2008, p. 23) writes that one of the most important roles of school leadership is bringing all teachers to a high level of pedagogical effectiveness. Therefore, it is no different when it comes to leading a school in the digital age (Kolodny-Cole, 2003; Lee, 1991; Fullan, 2008; Halford, 2009).

For the classroom observation to be an effective learning opportunity for the teacher, the observer (principal/leader) must be able to discuss with the teacher the specifics of teaching and learning in that person's classroom (Lee, 1991). However, classroom observations are not the only strategy that needs to be undertaken. To enable schools to develop in this increasingly complex and challenging environment requires teachers and leaders to share instructional expertise and explore learning communities through the use of sense-making reflective practice. The leadership needs to create regular opportunities for teachers to engage in conversations about their work, focusing on the ways they interpret events and how their interpretations influence instruction. This type of learning environment can be best encouraged through supportive professional standards and school culture (Lee, 1991; Little, 1982; Sergiovanni, 2006).

> *One of the great secrets of leadership is that before one can command the respect and fellowship of others, she or he must demonstrate devotion to the organization's purpose and commitment to those in the organization who work day by day on the ordinary tasks that are necessary for those purposes to be realized (Sergiovanni, 2006).*

As Greenleaf (1976) points out, people "will freely respond only to individuals who are chosen as leaders because they are proven and trusted as servants. The issue of leadership is significant when it comes to the implementation of ICT in schools. Fullan (1991) perceives the future role of the Principal in 'Models of the Future' will be to encourage collaborative groupings of teachers to play a more central role in the instructional leadership of the school. Since the Principal is the key figure in promoting a positive school environment conducive to student learning, this will require active participation of the Principal to facilitate change (Lee, 2008; Schrum & Levin, 2009).

As change requires empowering all stakeholders, it is important therefore, the Principal motivate staff and students, by reaching out to the community and undertaking to continually improve the school (Fullan, 1991, 2011; Lee & Gaffney, 2009). Buffie (1989, p 11) asserts "good teacher morale and high student achievement go hand-in-hand" and the creation of such a setting does not just happen since it takes the combined effort of the Principal and the staff to identify factors that create and inhibit the development of a positive climate. Working in partnership takes cooperative team work to develop strategies to promote the desired climate or to overcome inhibiting factors. Jacobsen & Hunter (2004) argue educational leaders need to manage change, staff development, retention and other changes that arise from the realisation of any educational reform, let alone ICT implementation.

The integration of digital and communication technologies within educational settings is a significant force driving change. Fullan (2001) asserts the integration of technology into teaching and learning has affected the traditional roles and responsibilities of educational leaders. Leaders are being faced with the dilemma of leading in a culture of constant change. They must understand change, build relationships, inspire colleagues with a moral purpose, build shared and reliable knowledge structures and develop coherent organisations which respond effectively to the quick pace of technological change (Fullan & Smith, 1999). Lee and Gaffney (2009) believe "along with quality teachers, the effective development of digital

schools requires principals with the capacity to lead" without that commitment and knowledge the school has little chance of becoming a digital school. They go on to say, this means the "principal is the key educational leader in the school and needs to not only understand the technology but also taking the main responsibility for technology and its use" (p. 9).

Leaders are being asked to manage a rapid response to ongoing and emerging concerns arising from technological and human infrastructure and to re-balance the implementation of ICT with other school priorities (Jacobsen & Hunter, 2004). Jacobsen and Hunter continue by stating educational leaders are focusing on acquisition, implementation, management and the constant up-grading of digital resources often in a resource constrained environment. They argue leaders must focus on the professional development needs of teachers since it is expected teachers will adopt and optimise educational technologies and develop within learners social and equity needs without ever having used digital tools in their own teaching. Furthermore, Anderson & Dexter (2000) noted educational leaders have to make sound decisions about both professional development opportunities for teachers and acquisition of technology resources. Hence, the role of leaders, teachers and learners has expanded from knowledge transfer to knowledge creators as each comes to terms with the integration of digital and communication technologies.

Researchers (Cusack, Gurr & Schiller, 1999; Jacobsen & Hunter, 2004; McKenzie, 2000) found effective ICT implementation is due to strong leadership and that leadership is the driving force behind improvements in the school's ICT teaching and learning. Factors that underpin an effective leader's role include not only a strong pedagogical foundation but also the management of resources and timing; the recognition and support of coordinators to manage ICT issues and the need for effective professional development that not only up-skills teachers but also addresses pedagogical issues related to integrating ICT into the curriculum. A strong leader ensures there is provision of information and guidance to assist the school to evaluate the effectiveness of ICT-based programs (Lee & Gaffney, 2009). Guidance should also be given to ensure the availability of the best ICT-based resources. Success also

relies on the extent to which the curriculum is prescriptive about the use of ICT and should have a clear vision on a more flexible way to use ICT resources across the curriculum. Supporting educators in their role as knowledge creators by ensuring there are reliable and quality ICT resources contributes to the effective implementation of ICT in schools (Larson, Miller & Ribble, 2010). Schoeny (2002) believes the challenge for educational leaders is to assume a proactive leadership role, blending past accomplishments and present plans to provide support for the integration of ICT in a timely and effective manner.

2.11 School Culture

Even though today's students are referred to as digital natives the results of a survey conducted by MCEETYA in 2005 indicated student use ICT in limited ways. They survey found that communication with peers and the internet were frequently applications used, and that applications involving creating, analysing or transferring information were less frequent (MCEETYA, 2008).

According to Warner (2006) change needs to be embedded into the school culture and part of this change must affect the student culture within the school. Students need to see that learning is about change, that new learning is created by change and the learning they undertake reflects the realities of their rapidly transforming world. If schools expect to see a solid return on technology investments they must foster (and fund) cultures intent on continuous learning and change. High expectations must be accompanied by substantial resources (McKenzie, 1998). However, Prensky (2005) states schools are the second key barrier to technological adaption, because of their resistance to change. He goes on to argue many schools ban new technology and even when they try to move forward they face anti-technology pressure from parents demanding schools go 'back to the basics'. Lee (2010 p. 35) writes "it appears a human construct of the Industrial Age is markedly limiting schools to better harness the technology in the desired education of the young". If the education for future generations is going to be relevant, meaningful and engaging then teachers

and administrators need to experiment and trust their students with the technology (Prensky, 2005; Lee, 2010).

The implementation of ICT in schools is not an end in itself but a strategy to improve the quality of teaching and learning (Lewis, Jenson & Smith, 2003; Lee, 2011). Cuttance (2001) noted that evidence from research suggests teachers' pedagogies and pedagogical reasoning influences their use of ICT. Rogers (2004) & Cairncross (2003) suggest some of the early enthusiasm for educational ICT has waned and experience has shown effective use of ICT as a teaching tool in classrooms for areas other than basic computer literacy is harder than was initially expected. ICT is unlikely to save money as it involves heavy initial infrastructure costs, recurring costs to replace hardware and software, ongoing expense for professional development and the development of teaching and learning resources. He believes many educational policymakers seriously underestimate the total cost of operating ICT base learning. According to Cairncross (2003) to get the best from ICT depends on several variables:

- including appropriate design of software and hardware;
- training and attitude of teachers; and
- the realisation that different students have different requirements.

Getting the best from ICT also requires a willingness to experiment: effective use of ICT in education and training requires different pedagogical techniques from traditional classroom teaching. Teachers are often unsure about how to effectively integrate technology into their teaching and learning and often administrators have little, if any, guidance to give them. Therefore, where technology could enhance teachers the most is often neglected because adding digital technology to current practice is often disruptive to what schools do and the pressure of high stakes testing often exacerbates the problem (Prensky, 2005).

Furthermore, technology is not a substitute for good teaching. Without skilled teachers no electronic delivery can achieve good results but neither can traditional classroom teaching (Cairncross, 2003; Smerdon, et al., 2000). Fullan & Smith (1999) and Murcia & McKenzie (2008) suggest technology will necessitate teachers to change their pedagogy for learning to become relevant and meaningful so that students acquire the necessary knowledge and skills to be productive citizens in a global economy. Collectively these authors state "the more powerful technology becomes, the more indispensable good teachers are".

Table 1 in Fullan & Smith (1999) illustrates the shift in the nature of the learning environment. It shows how a traditional classroom environment is/was and compares it to what a constructivist or integrated classroom would/should look like if students are to construct knowledge and meaning in order to achieve deep understanding.

Table 1

Traditional learning environments versus new learning environments

Traditional Learning Environments	New Learning Environments
Teacher centred instruction	Student centred instruction
Single sense stimulation	Multi-sensory stimulation
Single path progression	Multi-path progression
Single media	Multimedia
Isolated work	Collaborative work
Information delivery	Information exchange
Passive learning	Active/exploratory/inquiry based
Factual, knowledge-based	Learning
Reactive response	Critical thinking and informed
Isolated, artificial context	Decisions

Note: From US Department of Education 1998

Fraser (2001, p. vii) maintains "teachers should not feel that it is a waste of valuable time to put energy into improving their learning environments because research convincingly shows that the attention to learning environments is likely to pay off in terms of improved learning outcomes".

2.12 Teacher Attitude

> *Technology will never replace teachers - but teachers who incorporate technology as a tool expand the horizons for their students (ASP Infrastructure trial, 2002).*

Few educational issues spark a more intense debate than integrating technology into the classroom. A paper by Finger, Jamieson - Proctor, & Watson (2005) concludes that accompanying the provision of increased computer numbers in schools, there has been an increased awareness of the important role teachers' play in enabling effective integration of ICT into the curriculum. McKenzie (2003) debates that technology integration should support a solid curriculum not dominate it. That it should assist students with problem-solving and create a collaborative learning environment whereby the teacher sees the transition of their role from facilitator to that of learner.

According to Mueller et al. (2008) and Ertmer (2005) a teacher's pedagogical belief about how technology does or does not fit with those beliefs, may be a determining factor in ICT integration into teaching and learning. Previous research has identified both extrinsic (first order) and intrinsic (second order) variables as potential barriers to successful integration of new technologies into teaching and learning. Mueller et al. (2008) posits although extrinsic barriers are an important consideration it is the intrinsic or second order barriers, which include individual beliefs, attitudes and skills amongst educators that is the key to effective integration of ICT into teaching and learning. Ertmer purports teachers are likely to use their past experiences, beliefs and attitudes about teaching and learning to develop their beliefs about new technologies as a teaching or instructional tool. Mueller et al. (2008) supports

Ertmer's assertion that teacher's attitudes play an important role in supporting or inhibiting the integration of new technologies into teaching and learning. They go on to say that even though today's teachers are familiar with the new technologies they may not be using it to its full potential as a cognitive tool due to their lack of experience, knowledge and understanding on how to effectively integrate technology to support student learning.

BECTA (2003a p. 2) suggests effective teachers set high expectations and communicate directly to pupils. They challenge and inspire pupils in order to deepen their understanding and knowledge, whilst setting clear teaching objectives and spelling out the relationship between these objectives and the ICT being used. Effective teachers model the behaviours they wish to teach and develop the necessary understanding through their own use of ICT (BECTA, 2003b). Franklin, Turner, Kariuki and Duran (2002) suggest if teachers are going to make effective use of ICT tools then teachers must redesign lessons around technology resources, solve the logistical problems around how to teach with limited resources and adjust the role of the teacher for a classroom transformed by technology.

Means & Olsen (1995) report educators were asked what kind of changes teachers would experience if they were to implement a new learning approach. They noted the use of new materials and regular technology was important but only the tip of the implementation iceberg. The more difficult elements are related to the development of new skills, behaviours and practices associated with the change and the acquisition of new beliefs and understandings about change in the minds and actions of educators. In addition, Fullan (2001) and Cox et al. (2003) report teachers' own pedagogical beliefs and values play an important part in shaping technology-mediated learning opportunities. Teachers need to investigate new pedagogies that will enable them to acquire and apply extensive new knowledge and understanding about how to identify and select appropriate resources to effectively integrate ICT into their teaching and learning (Fullan, 2001; Cox et al., 2003). Likewise, Cairncross (2003, p. 2) asserts "technology is never a substitute for good teaching".

Essentially this means that good pedagogy and skilled teachers are required in all learning environments.

2.13 Leadership and Implementation Influences

To enable the cultural and pedagogical changes to be successfully sustained, teachers need to become accomplished in using new technologies to enhance outcomes for students. Hooper and Rieber (1995) believe many teachers do not realise the potential benefits of using new technologies because they fail to 'break through' the critical third integration phase and as a result many new technologies become misused or discarded. To ensure this is not the case in Education generally, there are many implementation influences that need to be considered.

2.13.1 Leadership

School leaders, particularly principals, need to be aware of government expectations.

> *"All schools will seek to integrate information and communication technologies into their operations to improve student learning, to offer flexible learning opportunities and to improve the efficiency of their business practices" (MCEETYA, 2005).*

Research conducted by Moyle (2006) indicates school leaders matter and pedagogies must come before technologies. She also indicated that participants in her research believe a school or school system must have effective policies and practices to incorporate ICT to support teaching and learning. Moyle (2006) and Larson et al. (2010) state there are five key considerations for leaders of the 21st Century. These are: visionary leadership, digital age learning culture, systematic improvement, excellence in professional practice, digital citizenship and digital leadership. Many school leaders are challenged by the integration of technology into education. However, the implementation of ICT into schools is the responsibility of the school principal who needs to guarantee the best interests of the students are served through effective ICT infrastructure and staff professional development (Gronow, 2007).

Additionally, working alongside school leaders are classroom teachers who also need to evaluate their teaching practices to provide for new age students with the aim of developing systems and structures that excite, engage and motivate the 21st century learner. Therefore, to promote lifelong learners, schools need to invest and use technology to accommodate new learning styles (Gronow, 2007).

Leadership plays a key role in a school's success according to Peterson (1999) and Anderson & Cawsey (2008). However, many leaders and policy makers link the use of technology with pedagogical change. Unfortunately this is not always the case because if teachers are still driven by a traditional culture they tend to use technology for low level activities to supplement or support traditional modes of teaching or as a remedial tool to reinforce basic skills (Chung, 2005). Therefore, visionary leadership and effective professional learning of teachers is a key to the overall effectiveness of ICT integration into teaching and learning because without a pedagogical shift teachers will teach technologies whilst continuing to use old methods (Trinidad, 2005; Newhouse, 2010).

Consequently, effective teaching and learning with new technologies depends on the teacher being supported and encouraged by leaders at all levels of the system. At the school level, the principal plays a vital role in promoting pedagogies that support the effective integration of new technologies into teaching and learning (MCEETYA, 2005).

Duignan and Gurr (2007) identified eight key motivators for effective leaders. They are:

- a clearly articulated philosophy and deep moral purpose;
- an unwavering focus on all students and their learning needs;
- a passionate belief in the significance of what they do;
- a commitment to making a difference;
- a focus and valuing of people;

- strong support for learning, growth and development;
- an expectation for high professional standards;
- a collaborative, collegial and inclusive school culture.

November (2010) argues we need leaders who can help their colleagues understand how to move to a team-based environment. He asserts teaching teachers to use technology is relatively simple but to get teachers to share ideas to build relationships is far more complex. November states "leaders do not need extensive technological skills; however they do need to understand how to support risk-taking teachers and how to craft a vision where technology is clearly viewed as simply the digital plumbing" (November 2010, p. 6). Moreover, Newhouse (2010b) and Hargreaves & Shirley (2009) argue the value of strong leadership and believe it is essential to guide change efforts. Additionally, Newhouse (2010b) writes "international research (Becta, 2006; Moyle, 2006; Stuart, Mills, & Remus, 2009) has consistently found that the leadership and organisation of a school are critical factors in the way in which educational technologies such as computers are used and their subsequent impact on learning opportunities in schools".

Furthermore, Dexter, Anderson & Becker, (1999) and Trinidad (2005) suggest teachers who are engaged in school planning for the integration of new technologies in education are more likely to implement these plans than teachers who have not been part of the process. They go on to conclude that successful ICT integration depends on shared goals and that **a** school plan with clear and defining goals is a crucial step towards effective ICT integration. However, Newhouse's research indicate implementing the effective use of ICT in schools is a complex task usually requiring school leaders to facilitate substantial organisational change and tended to show characteristically in schools critical decision-making concerning ICT rests with one or two people, usually the Principal and/or the ICT coordinator (Newhouse, 2010b).

Dexter et al. (1999) and Dawson & Rakes (2003) support claims that leadership is a key factor in promoting change when it comes to any educational reform and, in

particular, the effective integration of new technologies into teaching and learning. Baylor and Ritchie (2002) also describe leadership as a critical predictor in the effective integration of new technologies into teaching and learning and strongly believe school principals need to join in rather than sit on the side lines if they aim to nurture a culture of innovation and change using technology.

Schools already engage ICT for organisational management. Therefore, the focus should be on encouraging teachers' use of ICT by acknowledging and actively promoting ICT as integral to the teaching and learning process. Furthermore, the effectiveness of school leadership may have important links to classroom ICT integration. For example, decisions regarding ICT spending, deployment and building design can directly affect how a teacher uses ICTs in the classroom. These factors, if not addressed, may even prevent willing teachers from integrating new technologies (BECTA, 2005).

2.13.2 Teaching with Technology

"Slowly but surely, technology is changing the way teachers teach – and how kids learn" (Hill, 2002). However, teachers are typically not receiving appropriate professional learning to support their knowledge and understanding of how to enhance classroom practices and integrate new technologies into their teaching and learning (Carlson & Gadio, 2002; Trinidad, 2001, 2005).

Cuban (2001) found many teachers who were reluctant users of technology in their classroom where making general use of technology in their daily lives outside the classroom and therefore believed the slow adoption of technology in the classroom was based on their individual beliefs about what schooling is.

According to Mueller et al. (2007) and Ertmer (2005) it is the beliefs, attitudes and skills of the teachers that will impact on education the most. They argue that although extrinsic barriers are import factors to consider when looking at effective

integration of new technologies into teaching and learning, educators are the focus of interest because they have the primary contact with students. In addition, it is the teacher's personal experiences with the barriers that will dictate the effectiveness of ICT integration.

According to Ertmer (2005) and MacDonald (2006) changes in attitudes and beliefs happen through personal and vicarious experiences as well as social cultural influences. Maybe teachers need to experience positive outcomes of technology integration, either personally or vicariously, through other teachers to enable a shift in their beliefs about ICT integration. However, even if a teacher has a positive disposition towards new technologies they must have the confidence to implement technology successfully in order to be able to enact their belief.

Warner (2006) asserts schools are proficient at weathering the storm of change long enough so as not to move too far from their comfort zone of adult control. However, if teachers are going to maintain their relevance for future generations they need to create an educational environment in which change can be enacted smoothly and new learning is passed on quickly. To do this teachers in the knowledge era may need to believe that change is a reality, take ownership of their jobs and feel empowered to work innovatively with students. Anderson (2005) contends that as "educators we have a duty to prepare our students for the future, and if we don't we are negligent in our duty".

In many schools across the world teachers are reluctant to integrate ICT into their teaching and learning for a variety of reasons, such as limited or no access to technology or that they are uncomfortable with the technology. This is a poor defence for not integrating technology in teaching and learning. On a daily basis educators' ask students to step outside their comfort zone and have a go at something new or different as part of their learning experience (Anderson, 2005). With this in mind, Anderson (2005, p 1) poses the question, "Therefore, should educators not be modelling to students that learning is a lifelong process?"

Integration of ICT occurs when teachers realise it may need a new approach to pedagogy and that it does not mean teachers need to discard many tried and true educational strategies and techniques as students still need their learning monitored and structured with a clear focus on learning outcomes (Gage, 2005). Research suggests, Cooley and Johnston, (2000), Carlson and Gadio (2002) and Trinidad (2005), teachers may reject technologies because they are incompatible with their philosophy of teaching and the daily realities of the classroom.

Many education experts are calling for greater integration of ICT into the classroom to guarantee today's students are equipped for the future. But, these changes should not be made just for the sake of business, but for the students themselves. Technology will not teach by itself, the teacher must be trained to use it and the curriculum designed to integrate it (Hill, 2002).

2.13.3 Professional Learning, ICT and Pedagogy

> *Transformation of schools to make robust and fully integrated use of new technologies represents a major shift in practice. We will not get there by offering training sessions. We must reconceptualise professional development so that we create learning cultures which make change and growth a daily reality (McKenzie 1998).*

According to Bowmen (2004) technology training alone will do little to change teaching practices because it does not deal with instructional design, teacher and student behaviour, or those beliefs that provide the basis for a productive educational environment. He goes on to argue that professional development is only effective when classroom practices change and students are able to demonstrate achievement of constant standards. If we are going to change the nature of education, the way kids learn**,** and the way teachers teach, then we need to change the teachers' belief about how students learn and the role of ICT in education.

Research cites professional development (not just one off workshops) as needing to be continuous during the initial implementation of ICT and that there also needs to be regular follow-ups (Downes et al., 2002; Fullan & Smith, 1999; Herdman, 1995; McKenzie, 2001; Martin, Strother, Beglua, Bates, Reitzes & Culp, 2010; Jamieson-Proctor et al., 2010). According to these authors and researchers good professional development by itself is not very effective but when coupled with a positive culture within the school, can make a huge difference. High quality professional learning is central to any educational reform, particularly involving the integration of technology in support of classroom instruction. To guarantee technology becomes an integral part of teaching and learning is influenced by high quality teacher professional learning and ongoing support (Martin et al., 2010). Pedagogical changes linked with technology have implications for the way teachers teach, and in the way in which they need to think about and understand teaching and learning.

For ICT to contribute to educational development, teachers must have plenty of scope and support to take advantage of new technologies. True change takes place through teachers, who are and will remain the key figures in learning but do not have the monopoly on teaching (Selinger, 2005). DuFour (2004) believes school leaders must end the distinction between working and learning and create conditions which enable staff to grow as part of their work routines. He states teachers must work together to develop curriculum that delineates the essential knowledge and skills students need to acquire. He believes effective staff development should be focused and led to the building of shared knowledge. However, to improve schools this shared knowledge must be applied to educators' teaching and learning practices.

Cox et al. (2003) also states the other influences on the implementation of ICT into teaching and learning are:

- access to ICT resources;
- teachers' knowledge of the potential of ICT and their confidence in using ICT in education;

- organisation, collaborative work and an insight into pupils' learning through the use of pedagogy beyond the classroom;
- the effect of pedagogical practices and the use ICT on pupils' attainment.

McKenzie (1999), Newhouse (2002) and Pearson (2001) support the view that there has been disproportionate spending on equipment compared to professional and program development and that we still have inadequate evidence to support the view that this expenditure has changed student performance. These authors report a need for sincere and robust investment into professional learning to help teachers learn how to use the new electronic tools in ways that count.

Cox et al. (2003) contends teachers' pedagogy and pedagogical reasoning influences their use of ICT and consequently is associated with students' attainment and improved learning outcomes. Students' knowledge of ICT as well as any changes in the classroom may be perceived as a threat by teachers. Teachers may not use ICT if they do not fully understand the educational purpose and value in its use. Cox et al**.** (2003) goes on to say that the effect on attainment is significant when students are challenged to think and to question their own understanding. Furthermore, if teachers are to understand and incorporate ICT into their programs then they need to develop pedagogy to achieve this.

Research shows that schools that only restructure make no difference in teaching and learning but schools that re-culture do make a difference if they focus on student learning, link knowledge of student learning to changes in teaching and learning and work together to make improvements (Fullan & Smith, 1999; Elliot, 2004; Buckingham, 2007).

Many researchers contend that the most effective uses of ICT are those in which teachers and the software challenge pupils' understanding and thinking (Atkin, 1997; Cox et al., 2003; McKenzie 2003; Murcia & McKenzie, 2008; Martinez, 2010).

Research carried out by BECTA (2003 & 2005) suggests important influences on the implementation of ICT in schools are access to ICT resources. BECTA maintains that the amount and range of ICT resources available to teachers (limited computers equal limited impact) affects its implementation. For example, the whole class use of electronic whiteboards has both positive and negative effects on student learning. On one hand it promotes pupil debate and helps students to visualize difficult concepts and processes**.** But on the other hand some teachers focus only on the presentation and disregard the use of stimulus and modelling, which might be more challenging for the pupils. BECTA goes on to report that the teacher's knowledge of the potential of ICT in education also plays an important part and that few teachers have a comprehensive knowledge of the wide range of resources available in education. Coupled with this is the teacher's confidence in using ICT which can affect the way lessons are conducted; many teachers still fear some forms of technology thereby preventing them from making use of new technology in their teaching.

When teachers fail to appreciate that interactivity requires a new approach to pedagogy, lesson planning and the curriculum then the use of ICT has limited impact on the teaching and learning process. Research conducted by Smerdon et al., (2000), Becker, (2001), Cox et al., (2003) and Trinidad, (2005) found the majority of teachers use ICT to add to or enhance their existing practices. They maintained teachers still need to adopt a leadership role in the planning, preparation and follow-up of lessons. The effects of pedagogical practices on pupil attainment may be associated with the way in which teachers select and organise ICT resources and how this use is integrated into other activities in the classroom and beyond (Becker, 2001; Cox et al., 2003; Smerdon et al., 2000; Trinidad, 2005).

Effective pedagogical practices with ICT should be part of a teacher's pedagogical framework if they are to integrate ICT effectively into teaching, learning and the curriculum (Watson, 2001, Jamieson-Proctor et al., 2010). Cox et al. (2003) state to do this there are, significant practical considerations: from the teachers' standpoint they need to understand the relationship between the range of ICT resources, concepts, processes and skills and use their expertise to select appropriate tools

which will help them meet the specific learning outcomes both in terms of challenging pupils' thinking and extending their learning. Hence, they found it is important for teachers to know how to prepare and plan lessons, to challenge people's understanding, to promote greater thinking and reflection and to recognise when the use of ICT will be most effective.

According to Cox et al. (2003) and Trinidad (2005) teachers need to develop confidence in using a range of ICT resources and appreciate that the use of ICT will change the way in which knowledge is represented. Finally, there is the issue of the need for substantial support and continual professional development to enable teachers to integrate ICT and improve pupils' attainment through the implementation of ICT (Cox et al., 2003; Ertmer, 2005; Prestridge, 2010).

2.13.4 Cultural Changes

Effective schools deploy their resources strategically to enhance teaching and learning and improve student outcomes. In developing a school culture which is supportive of teachers' professional learning, builds collaboration between teachers and encourages them to come together and support each other will impact on student learning. Therefore, the culture of a school is integral to teaching and learning outcomes (Anderson & Cawsey, 2008). The learning culture of a school is extremely important; however the professional learning activities need to be aimed at improving the teaching-learning relationship, paying particular attention to developing the content and pedagogical knowledge of teachers (Elmore, 2002). Fullan and Smith (1999) state "good professional development by itself is not very effective" and that there is a need for a change in school culture since 'the culture of the school makes a huge difference'. Strong evidence suggests a collaborative culture make a positive difference in teacher and student learning and schools that only restructure (change curriculum, add new roles, reorganise) make no difference in teaching and learning (Fullan & Smith, 1999; Wehlage, Smith & Lipman, 1992). However, schools that re-culture as well as restructure do make a difference if they focus on student learning, link knowledge in student learning to instructional practice

and work together as a team to make improvements (Anderson & Cawsey, 2008; Fullen & Smith, 1999).

Schools must become learning organisations (Fullan, 1995; Silan & Mulford, 2000). In addition, Fullan and Smith (1999) also express the view that innovations in technology have been part of the problem and not part of the solution. Their report states that even with additional financial resources to attend 'one-shot workshops' and purchase software, technology and new machines that often these resources are not connected to the curriculum let alone whole school improvement. In sum, maximising the learning potential of students requires a collaborative school culture that is open to changes in instructional practice.

Elliott (2004) found that the introduction and adoption of ICT in schools, mirrors many other educational innovations. In some schools it was slow and steady while in others it was not at all but rarely did a school leap headlong into an innovation. She found that even though digital resources were available and millions of dollars had being put into ICT resources and training the teachers are uncertain about their use and uptake across the board has been slow. Elliot explains that the research shows 'early adopters' are likely to be innovative visionaries who go the extra mile. In those classrooms where teachers are more computer active there are characteristics of strong communication with parents, excitement about teaching, positive attitudes, enthusiasm, confidence and expertise in teaching. According to Elliot the teachers who articulated a strong commitment to ICT in learning were good classroom managers and tended to be involved in a wider than normal range of school activities. She concludes that teachers must be prepared to alter their conceptions of teaching and learning as change occurs when new understandings of the task and processes are constructed, not simply when technical innovations are introduced (Elliot, 2004).

Research findings indicate that changing deeply held beliefs about pedagogy requires help from educational leaders therefore; school principals have a key role to play in

successful integration of ICT in schools (Ertmer, 2005; Fullan 2001). Likewise, Mulford (2005) reports that when leadership encourage, support and respect teachers and involves them in decision making it does make a difference. Hence, successful school reform is about development and therefore, learning. In 2003 Mulford stated 'the real challenge facing most schools is no longer how to improve but, more importantly, how to sustain improvement. Sustainability will depend upon the school's internal capacity to maintain and support developmental work and sustaining improvement requires the leadership capability of the many rather than the few" (Mulford, 2003).

> *The technology will necessitate that teachers change their pedagogy for learning to become relevant and meaningful for students to acquire the necessary knowledge and skills to be productive citizens in a global economy (Fullan & Smith, 1999).*

2.14 Conclusion

The literature presented in this review sets the context in which this research is carried out. The review of international and national literature over time enables the reader and researcher to form an understanding of how technologies have been received and implemented in settings outside of Western Australian primary schools. The findings contribute to the background needed to understand this current research. Much of the literature dates back to the 90s and 2000s because this was a time when research into new technologies was given a strong emphasis with governments and global communities (Lee, 2010). Lee reports that "the shift of schools to the digital began gradually but sadly the preoccupation in both the government and general literature is the technology itself rather than the creation of an educational environment that will allow teachers to best use the appropriate technology to assist their teaching" (p.31).

There is compelling evidence in the literature that suggests that while technology has been in Australian schools for over a decade the full potential of ICT in teaching and learning has not been realised in many schools (Education Department of Western Australia, 1998). Governments around the world have been working to harness the

power of information communication technologies (ICT) to improve educational opportunities, boost outcomes and energise the learning experiences students (Trinidad, 2005). Lee (2010) writes that there still is the assumption by many in 2010 that somehow the form of the place call schools is immutable and will never change and school leaders still don't believe that the basic form of schools will ever change despite the dramatic changes occurring in an ever more digital and networked world.

From the literature review it was evident that:

- Many education systems have policies in place which become the driving force behind what is taught in schools so it is important to examine the various policies that influence the use of ICT in education (DER Strategic Plan, 2008; Koh & Lee, 2008; MCEETYA, 2001; Newhouse, 2002).

    - In the United Kingdom, the Qualifications and Curriculum Authority asserts that ICT "is an essential skill for life and enables learners to participate in a rapidly changing world" (Qualifications and Curriculum Authority, 2007) and ICT is compulsory within the National Curriculum (http://www.nc.uk.net).

    - In the United States, the National Literacy Act includes the ability to use computers in its definition of literacy and many states have programs to monitor student ICT literacy (Crawford & Toyama, 2002).

    - In Singapore the ICT Master Plan 1997 -2008 emphasis the need for human capital development through its education policy through the learning to think, thinking to learn. This policy aims to create a better balance in the curriculum between the acquisition of factual knowledge and the mastery and application of concepts whilst developing the individual curiosity, creativity

and enterprise of its people and the important role ICT plays in this reform (Koh & Lee, 2008).

- The New Zealand e-Learning action plan for 2006-2010 sets out to cultivate effective teaching through developing teacher capacity, leadership and learning resources and curriculum materials. It aims to achieve this through a culture of reflective practice, knowing what works and exploring emerging possibilities (New Zealand Ministry of Education, 2006)

- In Australia, governments and school communities throughout the country are working to harness the power of ICT to improve educational opportunities, boost outcomes and energise the learning experience. Major investments have been made through the installation of infrastructure, creation of online resources and professional learning opportunities for teachers. Although, there has been significant process made and many teachers and students have access to digital hardware and resources only a minority are reaping the full potential of the digital revolution (DER Strategic Plan, 2008).

- Western Australia is investing in developing teacher ICT competencies through providing online professional learning through a partnership with SchoolKitpd21 (Teachers have Class) program and Schools Online Curriculum Service (Department of Education, 2010).

Most of the literature focuses on how ICT is transforming the way we teach, the way in which children learn and the way the school is managed. While there is considerable progress being made in the adoption of ICT in reality the literature reveals that there is a huge variation across countries and states, from school to school and system to system.

In reviewing the literature on leadership it is evident that principals play a major role in facilitating the implementation of ICT and can influence the organizational and social culture of the school through intervention (Schiller, 2002; McKinsey, 2007). This approach challenges teachers to effect change in the way they teach and incorporate ICT into their pedagogy so that ICT can be integrated into the learning process. Principals therefore, have a key role as architects and communicators of the vision for teaching and learning and through their involvement can influence the role of ICT in this vision (Lee & Gaffney, 2009; Schiller, 2002). The McKinsey report (2007) goes on to state that strong school principals who focus on the success of every child in their school, focuses on instructional leadership and not on school administration. Whereas principals "who spend most of their time on tasks not directly related to improving student learning and achievement, thus limiting their capacity to effect real improvement in student outcomes" (McKinsey & Company, 2007, p. 30).

The implementation of ICT can be promoted through the budget, professional development and by either action or inaction on the part of the Principal. To sum up interventions which increases the potential for the success or failure of any change is dependent on the Principal who has 'considerable impact on the organizational and social culture of the school through the type and style of interventions they make' (Schiller, 2002).

This chapter has reviewed the literature, examining the background and brief history of ICT in primary education. It looked at the global, Australian and Western Australian context in regards to ICT in primary schools and the pedagogical justification investigating the elements of curriculum reform, professional learning and leadership. Other elements explored were empowerment of teachers through professional learning, pedagogical change, school culture, teacher attitudes and implantation influences.

The literature review has identified the ubiquity of ICT in primary school education. Some additional factors have some bearing on the use of ICT in teaching and learning were produced some of these include that rapid changing technology access, internet usage, an aging teaching population and financial imperatives to make learning more cost effective contributed to the background needed to understand this current research.

The following chapter explains the methodology used; how the samples were selected and the instruments used to gather data to conduct the research on the teaching and learning with ICT in primary classrooms.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter describes the framework and research process that was adopted to determine the data that would be collected to map the integration of ICT into teaching and learning and to explore the variations that might be found. It includes a description of the research methods, data collection procedures and analysis procedures, together with the process adopted for evaluating and interpreting data. In this mixed methods study a variety of quantitative and qualitative data collection methods were used, to research topic and triangulate outcomes.

The methodological approach was mainly qualitative, though quantitative data was also collected through the use of questionnaire surveys. Cohen, Manion & Morrison (2003) report many educational research methods are descriptive; that is, they set out to describe and interpret what is (p. 169). Such studies examine the individual, group, institution, method and materials in order to portray the events that make up the inquiry (Cohen, et al. 2003; Stringer, 2004). The aim of this study (p 19) included an exploration of how far educators in Western Australian Government primary schools come since recommendations were made in the Auditor general's report (2001) and the findings from the DET Teacher ICT skills assessment (2006). This study is therefore located in the ethnographic (interpretive) paradigm (Cohen, et al 2003; Stringer, 2004; Burns, 2000). It seeks to provide an insight into teaching and learning with ICT in government primary schools by utilising a mixed-methods approach.

The epistemological basis for the selection of methodologies to answer the research questions was founded on an anti-positivist view. Cohen, et al (2003, p. 19) states the "opponents of positivism are united in their common belief that human behaviour is not governed by general, universal laws and characterised by underlying regularities". They also argue the "social world can only be understood from the

stand point of individuals who are part of the ongoing action being investigated" (Cohen, et al, 2003, p. 19). Therefore social science is seen as a subjective rather than objective undertaking, as a means of dealing with the direct experiences of people in a specific context (Cohen, et al; 2003; Stringer, 2004). Furthermore, the purpose of social science, according to Cohen, et al (2003), Burns (2000) and Fraenkel & Wallen (2003), is to understand social reality as different people see it and demonstrate how their views shape the action which they take with that reality.

An ethnographical paradigm was considered appropriate for this study because the research setting is a naturally occurring event. Burns (2000) describes ethnography as a study of people and writing about people, describing their social-cultural activities and patterns. In ethnographical research the ethnographer gathers data first hand and by compiling and organising this information the researcher can construct pictures of the cultural and perceptual world of the group being studied. Therefore according to Burns (2000) ethnography essentially involves descriptive data collection as a basis for interpretation and it represents a dynamic picture of the way of life for the group under review. As stated in Chapter 1 the purpose of this study is to provide new insights into the challenges that confront Western Australian Government schools in integrating ICT into teaching and learning and to investigate the relationship between leadership, teacher beliefs and practices in the integration of ICT in primary schools. Therefore ethnography is a relevant and appropriate method for evaluating the status of ICT in primary education as this context is essentially a cultural entity.

The aim of this research was to investigate 'Teaching and Learning with ICT in WA Primary Schools'. This thesis examines the pedagogical justification for investing in ICT in primary schools and Chapter 2 provided a comprehensive review of the literature and investigated current understanding of ICT in primary teaching and learning.

Finally, the chapter considers some of the assumptions and limitations that arise from studies of this kind. In all empirical studies researchers must make compromises hoping that, on balance, they have not detracted from the validity of the study and significance of the findings.

3.2 Research Questions

As other researchers have found, the specific research questions result from a progressive focus during the study and are probably the most import step to be taken in a research study (Kumar, 1996; Yin, 2009; Creswell, 2009). The research questions needed to be broad enough for the study to encompass all the relevant factors within the time and resource limitations available. A qualitative research methodology has been used as a primary data source for addressing the research questions, incorporating the use of a case study approach in an attempt to capture history of ICT in government primary schools in a meaningful way. In addition, quantitative data has been gathered to validate other forms of data collection. The following research questions were proposed:

1. Why use ICT in Western Australian Government primary schools?

2. What are the pedagogical justifications for investing in ICT in Western Australian Government primary school?

As stated in chapter 1 section 1.5 (p. 22) to do this a series of sub questions will be investigated using a theoretical framework (The Crash Investigation model). These are detailed below.

The environment (System/schools)

3. What support structures are required to encourage teachers to make pedagogical change for the successful implementation of ICT in the classroom?

4. What school cultures are most supportive of pedagogical change for the successful implementation of ICT in the classroom?

The driver (teachers/administrators)

5. What implications does teacher attitude play in successful implementation of ICT in the classroom?

6. What role does leadership play in the successful integration of ICT into the classroom?

The vehicle (policies/applications and outcomes)

7. What skills do teachers need in order to empower them to integrate ICT effectively in the classroom?

8. What role does professional learning play in the successful integration of ICT into the classroom?

Discussions with educational leaders frequently referred to policy documents and it became clear that these were considered important statements intended to guide classroom practice. With this in mind, research question one was devised. As the study progressed the researcher experienced a variety of practices in schools, indicating local responses to national policies. This linkage was therefore examined further in research question two. Exploring these issues with teachers and school leaders and relating the importance of change agents from the theory of innovation, the study focussed on their needs in the way of empowerment and professional learning addressing these in research question three - eight

The first research question was concerned with ICT as an example of innovation in primary school education. ICT can be seen as a 'driver' (Fullan, 2011) in the sense that technology itself determines the way in which it is used rather than the alternative view expressed by Fullan (2011) that pedagogy is the driver and technology is the enabling tool. This view suggests the impact of ICT is socially shaped (Kling, 2000). This aspect of ICT in primary education was examined through research into ICT policies at the local and national levels.

The second research question investigated implications and practices in regards to pedagogical justifications for ICT implementation in primary school education. Policy expresses the intent, but it is only one factor affecting classroom practice. Following the examination of policy (or intent) it seemed logical to investigate implementation and practice in the primary setting. This characteristic of the research looked at the degree to which the intent of policy makers was system (DETWA) inputs and what was reported and observed happening in classrooms.

Research questions 3 and 4 focused on the environmental elements needed to ensure effective implementation of technology occurred in primary education. Whilst research questions 5 and 6 focused on the empowerment of teachers and school leaders to be able to support and implement the policy initiatives.

Research questions 7 and 8 focused on teacher professional development and learning. The primary classroom is led by teachers, and the role of this person is critical to the adoption of any innovation in education to improve the outcomes of students. The way in which teachers have been trained is likely to be critical in determining not only the way in which ICT is implemented but also the nature of its use in teaching and learning. This has been an important issue in Australian schools (Downes, et al., 2001).

This study was organised using these research questions using the conceptual framework explained earlier (p. 22).

3.2 Design of the study

This research aims to explore whether government schools in Western Australia have supported teachers to integrate ICT in their teaching and learning. The key elements in this study are, firstl**y,** 'Why use ICT in primary schools?' Secondly, 'What is the pedagogical justification for investing in new technologies in primary school?' Finally, the role school culture, leadership and teachers attitudes and beliefs play in effective integration of new technologies in primary school were also investigated by

utilising literature reviews, questionnaires, interviews, and by applying a case study approach. The investigation has explored the effect the push for ICT is having on teachers, students and schools as well as how leaders in education have tried to overcome the perceived obstacles in integrating ICT in primary schools.

To address the research questions systematically, questionnaires were used to gather a broad cross-section of attitudes and beliefs from teachers and principals. The interview process and anecdotal – personal journeys presented in Chapter 4 were used on a small sample of participants to gain a more in-depth understanding of the implementation of ICT in teaching and learning. These personal journeys were used to validate the responses in the questionnaires. The case study was used to verify how teachers applied technologies in teaching and learning, teaching pedagogy and the ICT used in classrooms. A case study enables the researcher to gather data through various data gathering methods from real people in real situations, thereby enabling the reader to understand ideas more clearly than simply presenting ideas as an abstract theory (Cohen, et. al., 2003).

3.3 Methodology

This section describes the research process and includes a description of the research methods, data collection procedures and analysis procedures, together with the processes adopted for evaluation and interpreting data.

An ethnographic research was the method undertaken for this study on ICT. This paradigm is concerned with the links between people, culture and their behaviours. According to Fraenkel and Wallen (2003) the emphasis on ethnographic research is to obtain a holistic picture by documenting or portraying everyday experiences using a variety of approaches (p. 512). Moreover, Burns (2000) states "the basic ethnographic approach involves observation, organisation and interpretation of data" (p. 104) and Cohen, et al. (2003) describe ethnography as a portrayal of events that is subjective and reporting multiple perspectives using descriptions, understandings and

explanations of specific situations. Hence, to understand the impact of teaching and learning with ICT in primary schools Questionnaires (quantitative) were used to survey a wider population from various educational settings, to observe teachers in their classrooms and to conduct interviews (qualitative) to validate the findings. The data gathered through interviews and case studies is known as Qualitative research and is used to explore and understand people's beliefs, experiences, attitudes, behaviours and interactions. It generates non-numerical data through descriptions.

Qualitative research methods and the case study methods are outlined below in detail. This chapter will also describe in detail the sources of research data collected from both the leadership team and teachers in government primary schools across Western Australia.

For the purpose of this study qualitative research involves a disciplined inquiry that examines people's lives, experiences and behaviours, and the stories and meanings individuals ascribe to them. It can also investigate organisational functioning, relationships between individuals and groups, and social environments. However, according to Denzin & Lincoln (2005) their interpretive action is guided by "a set of beliefs and feelings about the world and how it should be understood and studied". In this way, researchers' beliefs about the ontology (the nature of reality), epistemology (their relationship with the known) and the methodology (the way of going about finding out about the world or gaining knowledge of it) shape how they see the world and act in it. In short, they are bound within a web of epistemological and ontological premises that exert particular demands on them in their research (Denzin & Lincoln, 2005).

This approach to research can involve the systematic use and collection of a variety of empirical materials such as case studies, personal experience, life stories, interviews, observations, and cultural texts. It may bring new insights into the experiences of individuals, groups or communities, or into issues such as environmental change, public policies and planning. Qualitative research may also

have quantitative elements or aspects (Cohen, et al., 2003). For this reason this research used a mix model method to gather data.

3.4 Case Study

Yin (2009) has argued that there was strong reason for using a case study approach. It is the preferred technique when the researcher has little or no control over events. In this research a case study structure was used to address the research topic 'Teaching and Learning with ICT in Government Primary Schools'. According to Shuttleworth (2008), a case study is a comprehensive study of a particular situation rather than an extensive statistical survey. Cohen, et al. (2003, p.181) writes "a case study can enable readers to understand how ideas and abstract principles can fit together". Furthermore, Cohen, et al. (2003) maintain that a "case study can establish a cause and effect, indeed one of their [case study] strengths because it enables the researcher to observe effects in real contexts recognising that context is a powerful determinant of both cause and effects" (p 181). Hence a case study investigates and reports the complex dynamic and unfolding interactions of events, human relationships and other factors in a unique instance (Cohen, et al., 2003).

A case study was the most appropriate method of inquiry to this study because it provides a holistic view of the school. This method can be defined as a study or detailed examination of a single individual or a single discrete social unit. Cohen et al. (2003, p. 79) describes the "purpose of a case study is to portray, analyse and interpret the uniqueness of the real individual and situation through accessible accounts. It enables the researcher to catch the complexity of the situations and present and represent reality through a sense of being there". Even though case studies have many strengths and weaknesses Cohen, et al. (2003, p. 181) maintains that "case studies can penetrate situations in ways that are not always susceptible to numerical analysis".

This case study is a detailed examination of how teachers use ICT to enhance teaching and learning in the classroom. This definition of a case study is supported by Miles and Huberman's (1994) definition when they define a "case study as a phenomenon of such some sort occurring in a bounded context". The bounded context of this research was the experiences of individual teachers who told their story, meaning that this study had a number of individual and unique cases. Over the past thirty years governments across the world have been investing huge amounts of money into the implementation of ICT in schools**.** The Western Australian Department of Education is no different. School A is one of these primary schools. Their story about the implementation journey of this initiative is similar to many schools within Western Australia. This presumption can be substantiated by the data collected from a range of government primary schools across Western Australia.

By using a case study method to focus "on process rather than outcome, on discovery rather than confirmation"(Burns, 2000, p.460) was intended to gain a comprehensive understanding of how ICT is integrated into teaching and learning in primary school classrooms and the impact it is having on learning outcomes.

This research design incorporated ethnographic field techniques such as participant observer, semi-structured interviews, as well as classroom observations and personal stories. Therefore this research used a modified case study approach which gathered data in an exploratory way, to build theory using site visits, interviews and questionnaires gather data and interpret the perspectives of those involved in the research study. This modified case study approach utilised a combination of data sources such as questionnaires, interview, personal stories and policy documents to explore the implementation of ICT in teaching and learning in Western Australian Government primary schools. According to Burns (2000, p. 405) a "participant observation is the primary technique used by ethnographers to gain access to data and researchers take part in the daily activities of people and reconstructing their interactions and activities in field notes taken on the spot or constructed soon after".

3.5 Procedure and Instruments

A questionnaire was development based on a previous study conducted by DET (2005) in order to gather information about the status of teaching and learning with ICT in Western Australian Government primary schools (see Appendix B).

A separate questionnaire for school leaders provided information about contextual and cultural characteristics and the school (see Appendix A).

3.5.1 Questionnaire Survey development

The questionnaire used in this study was developed from a series of documents which included:

- reference to the Department of Education's ICT skills survey;
- the Department of Education's Teaching and Learning with ICT: Self Evaluation Guide;
- a review of the other states and territories literature and questionnaires relating to the teaching and learning with ICT;
- a review of national and international literature and questionnaires relating to the teaching and learning with ICT; and
- pilot testing with a small group of teachers, with minor amendments to the survey form to ensure comprehension completeness.

The teaching and learning with ICT in the primary classroom questionnaire was designed to collect information about demographics of classroom practitioners and to seek their views on a range of matters relating to the ICT integration into teaching and learning, in particular in the following areas:

- the school's capacity to implement ICT;
- assessment of professional learning offered and undertaken to enhance schools and knowledge;
- school planning and leadership;
- attitudes towards ICT;
- beliefs about ICT integration into teaching and learning;

- the integration of ICT into teaching and learning;
- school capacity to support ICT integration;
- application of ICT in the classroom;
- leadership, teaching and curriculum;
- achieving outcomes;
- assessing student outcomes with ICT; and
- professional use of ICT/knowledge/practice/values and relationships.

The leadership questionnaire targeted practitioners in a leadership role. It was designed to collect information on the demographics of leaders and to seek their views on a range of matters relating to ICT integration into teaching and learning, in particular in the following areas:

- using ICT in learning and teaching;
- support and guidance;
- the teaching process;
- pupils' learning experiences;
- meeting students' needs;
- staff review and development; and
- professional knowledge and learning.

A copy of the teaching and learning with ICT in the primary classroom adapted from Teacher ICT Skills (2005) and leadership questionnaires can be found in the Appendices (Appendix A & B).

3.5.2 Teaching and learning with ICT: a self-evaluation guide

The teacher's ICT skills were evaluated using an evaluation sheet, "Teaching and Learning with ICT: A Self Evaluation Guide", developed by the Department of Education and Training, Western Australia (2003). The guide was developed to give teachers a tool that could be used to gain a sense of the individual's current skill and understanding of teaching and learning with ICT. It was a framework that took into

consideration the level of skills developed and in what areas. The structure of the guide is an assessment rubric that uses six Dimensions of Practice:

- Facilitating Student Learning,
- Assessing Student Learning Outcomes,
- Engaging in Professional Learning,
- Participating in Curriculum Policy and Program Initiatives,
- Forming Partnerships within the School Community, and
- Teachers' ICT Skills and Knowledge.

A list of the dimensions is given in Table 2 and it should be noted that Dimensions of Practice 1 and 6 have sub sections (see Appendix D).

Table 2 gives an overview the dimensions of practice identified in the Western Australian Department of Education teaching and learning with ICT self-evaluation guide for teachers. The guide is designed to support staff and school leaders who are focusing on improving their understandings of the use if of ICT in teaching, learning and assessment.

This guide is used to support educators develop an enriched repertoire of teaching and learning strategies and recognis**es** the many dimensions of practice that can be impacted on by ICT.

Table 2

Description of Dimensions of Practice

Dimensions of Practice
Facilitating student learning
• connection to CF (Curriculum Framework)
• student application
• attitude
• teacher as orchestrator
• repertoire of teaching strategies
• ICT access and use
Accessing student learning outcomes
Engaging in professional learning
Participating in curriculum policy and program initiatives
Forming partnerships within the school community
Teachers' ICT skills and knowledge
• **peripherals**
• **application**
• **online services**

Note: Adapted from Teaching and Learning with ICT: a self-evaluation guide, DETWA, 2003

3.5.3 Questionnaire Pilot

According to Cohen, et al (2003), piloting aspects of the questionnaire are extremely important but crucial to its success. A pilot has several functions, principally to increase the reliability, validity and practicability of the questionnaire. The pilot in this study was used to check and clarify the questions, instructional and layout of the questionnaire. To eliminate ambiguities or difficulties in wording and meaning, and to gain feedback on the overall useability of the questionnaire

A small number of participants (20 in total) were approached to complete a draft copy of the questionnaire as part of a trial. This trial was set to monitor the effectiveness and validity of the data instrument. From this trial changes and improvements based on participant's feedback were made to the questionnaire to reflect the information and comments received from the participants. Once these

changes were made schools were randomly selected from the DET website which included rural, remote and metropolitan schools at various levels. The size of the school determined the number of questionnaires sent. If the school was deemed a level 5 or 6 school five teacher and two leadership questionnaires were sent, a level 4 school received four teacher and one leadership questionnaire and a level 3 school received one of each. Schools were emailed the Survey Monkey™ link via the DoE District Education Offices requesting principals to pass the information on to their staff.

3.5.4 Interviews

The interview process was semi-structured with a set of guiding questions given to the participants (see Appendix C). According to Cohen et al. (2003) "interviews enable people to discuss their interpretations of the world in which they live and express how they regard situations from their own point of view (p. 267)." Participants for interviews in the study were selected through the return of a request form included in the questionnaire package sent to schools. Once the forms were returned by the participants willing to take part in an interview, an email was sent to confirm their involvement and interview dates were set.

In this study the questions were of a formal nature in which the interviewer (researcher) gave the participants a set of questions for the interviewee to address and the answers were recorded (see Appendix C).

3.5.5 Anecdotal Stories and Personal Reflections

Even though we see the world around us from our own perspective, we have a way of speaking about and sharing our ideas and experiences with others (Cohen et al., 2003). Cohen et al. (2003) refers to anecdotal stories as accounts. These accounts are part of the ethnographic paradigm which strives to view situations through the eyes of the participants to catch interpretations of situations (Cohen, et al., 2003, p. 293).

Participants for this section of the data collection were personally approached by the researcher who invited their involvement in the study but made them aware that there was no compulsion to participate and that at any time during the study they may withdraw without prejudice. Once participants' had volunteered to be part of the process discussions were held to outline the elements to be addressed in these personal reflections.

3.5.6 Observations

Observations enable the researcher to gather 'live data' from a given situation. The researcher is able to see for themself what is taking place rather than gaining the information second hand (Cohen et al., 2003). In this study teachers volunteered to be part of the observation process after completing a request form and returning it to the researcher. Collaboration between the researcher and the volunteer teachers was established and cycle of interviews and reflections conducted at a mutually agreed time.

3.6 Data Collection

A qualitative research method facilitates the study of an issue in depth and detail. According to Patton (1990) there are three kinds of data collection using the qualitative method of study. These are in depth open ended interviews, direct observations and written documents. Data collection in ethnographic research comes from two main sources; participant observations and interviews. In this study the researcher was the primary instrument of data collection through teacher and leader questionnaires, classroom observations, informal discussions with the participants, and personal interviews with teachers based on open ended questions and examining whatever documents that were available as data. Therefore, the data was presented by research questions, integrating the data from the different sources of evidence through triangulation (Yin, 2009). This practice uses multiple devices to investigate a single phenomenon, nonetheless was restricted in this case to a single observer, and therefore was potentially subjected to ethnocentric bias. However, the design of the study overcame this difficulty by obtaining data from several different sources.

Whilst ethnographic research limits the number of people that can be observed due to the resources available, the researcher was able to verify first-hand what is happening in most cases. Burns (2000) states "implicit assumption behind observation is that the behaviour is purposive and expressive of deeper values and beliefs" (p. 411). Hence, this limits the participant responding in a way that is detached from reality. Observations, on the other hand, are independent of subject and the subject's ability or willingness to report. Nevertheless, even though observations enable the observer to see first-hand what is happening within their setting, observations are time consuming and pose questions for the observer.

3.6.1 Interviews and Questionnaire surveys

According to Burns (2000, p. 566) questionnaires are the most commonly used method of gathering data in educational research to date. Questionnaire surveys can be both quantitative and qualitative and if well-constructed and administered provide a rich source of valid and reliable information. Morgan and Harmon (2001) define survey questionnaires "as any group of written questions to which participants are asked to respond in writing, often by checking and circling a response". However, Morgan and Harmon (2001) state that in their opinion questionnaire surveys cannot be called 'survey research method' because in a survey research method, a sample of participants is usually drawn from a large population. The purpose of the survey is to make inferences describing the whole population. Thus, the sample return rate is a very important consideration (Morgan and Harmon, 2001).

Morgan and Harmon (2001, p. 3) define interviews as "a series of questions presented orally by an interviewer and usually responded to orally by the participant". This was the preferred method used in this study.

In addition, this study uses interviews and anecdotes (personal stories) as a method of validating responses given through the questionnaire survey process. Cohen et al., (2003) categorises interviews as one of the most effective and frequently used methods in qualitative research. The questionnaires were used to gather a wide cross-section of attitudes and beliefs from educators about the integration of ICT into

teaching and learning and the role it plays in the classroom. The interviews and personal stories used on a smaller sample of participants to gain a more in-depth picture of how participants integrate ICT into teaching and learning. The interviews and personal stories verify how teachers interact with students and the technologies in their teaching and learning and the pedagogy they employ. Personal stories, or narrative research, are well suited to addressing the complexities and subtleties of human experiences. Narrative research records human experiences through the construction and reconstruction of personal stories and has the ability to focus on critical life events while at the same time explore holistic views (Webster & Mertova, 2007).

3.6.2 Data collection procedures

Once the fundamental point of the study was decided, an extensive review of literature was conducted followed by a candidacy research proposal and application for ethics approval for research involving humans. The first phase concluded when the Human Research Ethics committee acknowledged and approved the study.

The second phase of the study entailed designing and adapting the teacher and leadership questionnaires and developing interview questions. Once this was completed the researcher sample tested the teacher and leadership questionnaires on a trial group of 20 teachers and leaders. During this trial process the researcher met with the participants and asked them to evaluate the questionnaires and discuss whether the effectiveness and intent of the question had been achieved. During these discussions suggestions for classification and rewording were recorded. Hence, minor changes were made as suggested by the participants, to clarify any misconceptions. Once the questionnaires were amended the selection of participants and (schools) was carried out. To select the schools it was decided that 70 schools from the schools online website would be randomly selected and that the sample would draw from the four levels of schooling across Western Australia.

During the third phase of data collection permission was sought and granted from DET to conduct the study on Government school sites. Once this was in place the process of contacting schools to seek support from leaders and teachers to participate in the study began.

To begin the research, in 2008, seventy randomly selected government primary schools from across Western Australia were contacted via the postal service. Included in the post were 180 teacher, and 100 leadership questionnaire along with requests for interviews and self-addressed reply paid envelopes.

From this initial mail-out, seventeen teacher, and five leadership questionnaires with three interview agreements were returned. Due to the poor response, in 2009 a second batch of 200 teaching and one hundred leadership questionnaires were posted to a further seventy randomly selected government primary schools. As a result of this mail-out forty teacher and fifteen leadership questionnaires were completed with ten agreements to be part of an interview. Eleven teacher and four leadership questionnaires from three schools were returned not completed. After a brainstorming session with colleagues, an alternative method of getting the questionnaire out there was investigated. One idea explored was the use of an electronic survey program called Survey Monkey™. After signing up to the program and paying the appropriate subscription a questionnaire was designed based on the paper version sent to schools in 2008.

Contact was made with various District Education offices across Western Australia asking the directors for their support in emailing the survey link to the Principals in their districts. *The Western Australian Primary Principals Professional Association* (WAPPA) and various teacher professional organisations were contacted requesting their support to disseminate the questionnaire details by advertising the link in their monthly newsletter and encouraging principals and teachers to participate. This process netted 100 teacher and 85 leadership questionnaires from schools across Western Australia.

It was soon realised the only people responding to the questionnaire were those who had some understanding about using technology. Therefore, it became apparent there was a need to gather data from teachers and leaders who were struggling with the notion of using ICT. After approaching a local university requesting permission to send out questionnaires, to pre-service teachers via their practicum schools, two teacher and one leadership questionnaire was packaged for each student to take with them. Over eighty pre-service teachers took a package to their school and from this, four teacher and one leadership questionnaire was completed and returned.

3.11 Participants in the Study

A cross-section of principals and teachers from randomly selected metropolitan, remote and rural government primary schools in Western Australia were invited to participate in this study to gauge what they perceive to be the factors affecting implementation of ICT into teaching and learning.

3.12 Data Analysis

A multi-method grounded theory research design that used a questionnaire and case study approach with interviews, classroom observations and personal journeys allowed the conclusions from this study to be strengthened through triangulation and validation of multiple data sources (Cohen, et al., 2003; Burns, 2000; Fraenkel & Wallen, 2003). For this research the triangulation process was conducted by analysing several data sources to identify common elements.

With reference to the analysing of data, according to Fraenkel and Wallen (2003) "data analysis is one of the most interesting aspects of ethnographic research, and analysing begins from the first moment the researcher selects a problem to study and continues until the final report is written" (p. 521). Although there are many techniques used to analyse the data the main method is triangulation, since this establishes the validity of the observations, searches for patterns, identifies key events, prepares visual representations and uses statistics and crystallisation.

Triangulation enables the researcher to verify the data collected by using two or more data collection methods.

When analysing the data from interviews, the analyst needs to identify the categories in themes presented and look for common threads. The interviewer writes not only what is heard and seen but also their interpretations of what has been communicated. Data from the interviews can be analysed. There are four possible strategies for doing this. These being:

- Content analysis – it is deductive and works from a pre-existing understanding. It identifies themes, concepts and meanings. Categories are developed through logical deduction (Burns, 2000).
- Thematic analysis – grounded theory; this is when theories emerge from data and the analyst enters the project without any preconceived ideas of theories. It is more deductive then content analysis as the categories are not predetermined but introduced from the data as the researcher identifies the relationships (Burns, 2003; LSN Seminar, 2004).
- Narrative analysis – the researcher locates meaning from a succession of unrelated events. The researcher uses a variety of ways to identify narrative structure (LSN Seminar, 2004).
- Cultural studies - data is interpreted from thick cultural and social systems. Pre-existing theories are used to extract and investigate data to explore the operation of power. This strategy needs careful systematic observation (LSN Seminar, 2004).

The analyses from a questionnaire survey will depend on the structure used. If the questionnaire survey is closed then the analysis will be quantitative and the frequency of each response is represented as simple graphic representation. If the questionnaire survey is a mixture of closed and open ended questions than the analysis will be a mix of quantitative and qualitative interpretations identifying pattern differences and common threads. In this study a narrative analysis was adopted using the quantitative data collected to triangulate the responses.

The two procedures of interviews and questionnaire survey complemented each other by allowing the ethnographic researcher to use a combination of strategies to obtain optimal data. By using a combination of observations, interviews and a questionnaire survey it enabled one to clarify what had been written, spoken and seen to ensure the validity and reliability of any theories or interpretations.

When conducting research using these procedures in a complementary way the researcher could conduct the questionnaire survey first to gauge what the reaction and feelings were and then verify the findings by interviewing a cross section of participants in order to expand on the data gathered. These interviews were followed up with observations to gain a greater understanding of participants. Questionnaire survey techniques in ethnographic projects enable the researcher to gather background information on the participant under investigation. It can be used to check the representativeness of the data and hence to the generality of interpretations (Burns, 2000, p. 411).

In this study, data will be gathered from a wide cross section of educators through the use of questionnaire surveys, semi structured interviews, anecdotes (personal stories) and informal discussions with colleagues.

The quantitative questionnaires were analysed by using the SPSS™ software package (Norusis, 2005). The interviews and anecdotes were analysed through the use of common themes and trends to identify teachers' attitudes and beliefs about teaching and learning with ICT in primary school.

3.13 Triangulation, Validity and Reliability

Post positivist research tends to describe a world of variables and inert states, and must convince the reader that procedures have been followed reliably because there is little concrete description of what anyone has done (Firestone 1987; Yin, 1994,

2009). In contrast, interpretive research tends to describe people's actions in events, and must provide the reader with an interpretation in enough detail to show that the author's conclusion makes sense (Firestone, 1987; Yin, 1994, 2009). The following information provides a description of the quality standards associated with positivist and interpretive research paradigms as used in this study. It provides a description of the traditional concept of internal validity, external validity, reliability and objectivity as well as the equivalent post-modern view of credibility, transferability, dependability and confirmability. The latter four concepts are classified as the trustworthiness criteria for interpretive research.

3.14 Internal validity verses credibility

Internal validity refers to how well research findings match reality (Merriam, 1998, Yin, 1994, 2009). Satisfying internal validity then depends upon what view of reality the research takes. Researchers in the interpretive paradigm view reality as being holistic, multidimensional an ever changing. In contrast, researchers in the post positivist paradigm view reality as a single, fixed, objective phenomena waiting to be discovered, observed and measured (Merriam, 1998; Yin, 1994, 2009; Creswell, 2009).

In interpretive research the equivalent to internal validity is credibility. Different strategies for improving credibility of interpretive research includes the use of multiple sources of data; multiple methods of data collection and analysis, multiple perspectives with which to collect, describe or analyse data; member checking; and gathering data over a period of time but there is same research site (Merriam, 1998). Given that these strategies provide a more holistic and conceivable explanation and understanding of experiences being studied, they contribute to the credibility of the research (Mathison, 1988). Merriam (1998) also suggest involving participants in as many phases of the research as possible to enhance credibility, for example member checking. A further method of increasing credibility of the research is to state the researcher's biases and assumptions in full at the start of the work (Merriam, 1998).

In this study the researcher has a personal belief about the status of teaching and learning with ICT in government primary schools. According to Mehra (2002):

> *A researcher's personal beliefs and values are reflected not only in the choice of methodology and interpretation of findings, but also in the choice of a research topic. In other words, what we believe in determines what we want to study. Traditional positivist research paradigm has taught us to believe that what we are studying often has no personal significance. Or, that the only reason driving our research is intellectual curiosity (which is a valid reason on its own). But more often than not, we have our personal beliefs and views about a topic - either in support of one side of the argument, or on the social, cultural, political sub-texts that seem to guide the development of the argument.*

3.15 External Validity versus Transferability

While replication is essential in positivist research, Merriam (1998, p. 206) considers it 'impossible' in interpretive research, due to the multifaceted, highly contextual and emerging design of interpretive research. The term dependability has been used as the interpretive alternative to reliability, and relates to whether the results are consistent or dependable with the data collected (Merriam, 1998). To enable research to be dependable the whole inquiry process must be both 'tracked and trackable' (Guba & Lincoln, 1998, p. 242), and open to public scrutiny. Readers must be able to explore the process, judge the decisions that were made, and understand what factors in the context led the researcher to the conclusions made (Guba & Lincoln, 1998).

3.16 Strengths and Limitations

All research embeds decisions about the balance between available resources and the effectiveness of research method. Therefore, it was important to recognise the potential sources of bias and error in the conduct of the research.

The strength of ethnographic research is the comprehensive perspective it provides to the researcher. Fraenkel and Wallen (2003, p.524 & 513) state that "observing actual

behaviours of individuals in natural settings enables one to gain a greater understanding of behaviour and can revealed nuances and detail that other methodologies may miss". Ethnographic research lends itself to topics that are not be easy to quantify and suits topics best studied over time in natural settings. This seems ideal for this research. Since this paradigm is people oriented, it captures social reality therefore allowing the researcher to understand behaviour from the perspective of the participant (Burns, 2000, p.19). Nevertheless, ethnographic research is not an easy research model to undertake as it may lack a formal structure associated with other research methods. Cohen, et al. (2003) indicated case studies have strengths and weaknesses and cites Adelman et al (1980) and Nisbett and Watt (1984) as having identified these as:

Strengths

> *The results are more easily understood by a whole audience as they are frequently written in non-professional language.*
>
> *They are immediately intelligible; they speak for themselves.*
>
> *They catch unique features that may otherwise be lost in larger scale data and these features may hold the key to understanding the situation.*
>
> *They are strong on reality*
>
> *They provide insights into other, similar situations and cases, thereby assisting interpretation of other similar cases.*
>
> *They can be undertaken by a single researcher without needing a full research team.*
>
> *They can embrace and build in unanticipated events and uncontrolled variables.*

Weaknesses

> *The results may not be generalizable except where other readers/researchers see their application.*
>
> *They are not easily open to cross-checking hence they may be selective, biased, personal and subjective.*
>
> *They are prone to problems of observer bias, despite attempts made to address reflexivity. (Cohen, et al., p.184)*

3.16.1 Bias

Research needs to be free from bias and needs to be objective. Objectivity refers to the extent to which the research is free from researcher bias. The interpretive equivalent is confirmability, which refers to the extent to which the data can be traced back to its original source (Trochim, 2006). However, according to Cohen, et al. (2003) one of the advantages of the ethnographical approach to educational research lie in the insights that are made available through the analysis of social episodes. Nevertheless, researcher bias stemming from personal reasons and views for carrying out this research may be a problem and this was a consideration. Consequently, it was regarded as an acceptable limitation since the motivation component was a necessary element for this research to be completed.

3.16.2 Other limitations

There were further possibilities for error due to misunderstanding and communication problems. Efforts to eliminate these sources of error were considered through the use of a questionnaire pilot and participant cross-checking. While interviews were conducted in a friendly atmosphere, the researcher attempted to remain non-judgemental interacting with the interviewee as a means of airing the participant that their views and opinions were valued and to increase their openness. It cannot be determined to what extend their disclosure was influenced by this strategy or whether this resulted in any bias in the nature of their responses.

Another limitation of this research relates to the small number of participants in each area of data collection. While every attempt was made by the researcher to improve this rate, it was beyond her control. This however, in an in-depth case study approach, is not a limiting factor but a desirable one as more time can be spent with each participant.

3.18 Ethics Approval

This research was carried out in accordance with the ethics guidelines as indicated by National statement of Ethical Conduct in Human Research (2007), with approval for

the research being granted through the acceptance of the researcher's Application for Candidacy. Permission to conduct research on government sites was also granted by the Executive Director, policy, planning and accountability for the Department of Education and Training.

One of the main ethical considerations in this study was obtaining informed consent of the participants. The principles of informed consent arise from the participants 'right to freedom and self-determination' (Cohen, et al., 2003, p.51). In this study Ethics approval was sort and given by Curtin University and permission was sort from the Department of Education WA to conduct research on Department of Education and Training sites. Once this was obtained letters of invitation were send to Principals seeking their support in disseminating questionnaires to staff members willing to take part in the research.

A covering letter was attached to each questionnaire explaining the purpose of the research, ensuring that participants knew it was completely voluntary and that they had the right to with draw at any time. Requests for interviews were also attached to the questionnaire with a self-addressed envelope so the participants could return these separately from the survey therefore protecting their identity. They needed to know their role in the process and were treated with respect at all times. Participants were ensured that the information they provided would be kept confidential and the written and verbal information obtained was anonymous (see Appendix B for consent forms and information sheets).

3.19 Conceptual framework for evaluation

As a way of analysing the data gathered in this study via questionnaires, interviews, observations and personal journeys the researcher has selected a model for analysis utilised by crash investigators into fatal motor vehicle accidents. The framework is used by the Melbourne Metropolitan Crash Investigation Unit to uncover causes of fatal accidents when there are no witnesses (Antony, 2008). The framework enables

the investigator/s to explore multiple variables that may or may not contribute to the event before making a determination as to the cause of the accident (Western Australian Police, nd). A conceptual framework was developed by this researcher from this crash investigation model for use in this study. This model is presented diagrammatically below. It maps all variables from the Crash investigation model into a school environment.

In the model below this researcher has linked variables from the crash investigation model to the school environment in the following way. The factors in the Crash Investigation model are: the Environment, the Driver and the Vehicle. In schools and in this research the key factors are: the System/schools, the teachers/administrators and the policies/applications.

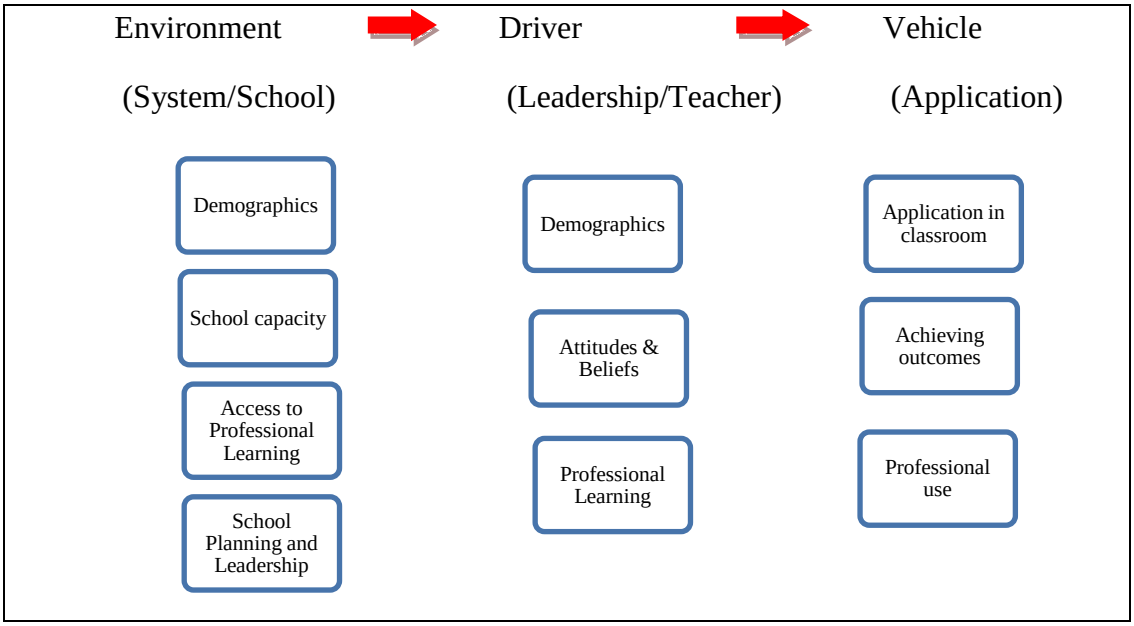

Figure 3: The conceptual framework used to analyse the data presented in the teaching and learning with ICT in primary classroom survey

In this model the environment represents the system (WA Department of Education) and or school. It looks at the factors of school capacity, access to professional learning and school planning and leadership. The next element, driver, represents

leadership and the teachers in schools and examines the factors of demographics, attitudes, beliefs and professional learning. While the final element**,** vehicle**,** represents the application of policy standards and procedures to implement ICT in schools and examines the factors of classroom application, achievement of student outcomes and professional use.

Professional Learning comes under both environment and driver because the system/school plays a role in providing professional learning to staff and the teacher/leader has a responsibility to access professional learning to enhance their own skills, knowledge and understanding in order to enhance learning outcomes for students. The area of demographic is included in both the environment and the driver because under the environment the researcher was investigating the demographics of the schools in regards to their size and location. For the driver the researchers was investigating the demographics in relation to the teacher/leaders age/ and gender.

This model was adopted by the researcher as a way of making sense of the all the data gathered, as a means of clarifying and organising it into workable modules.

3.20 Conclusion

This study encapsulates an array of methodologies to capture the nature of teaching and learning with ICT in Western Australian primary schools. Firstly quantitative data in the form of questionnaires was developed for teachers and leaders in schools, followed by qualitative data gathered through interviews, observations and personal stories.

This chapter has outlined the methodological framework for this research. The research used a qualitative case study approach, which allowed an in depth

investigation into teaching and learning with ICT in primary school classrooms and an ethnographic paradigm using the case study approach.

The next chapter presents the data collected from this study.

CHAPTER 4

RESULTS

4.1 Introduction

The last chapter described the research methods, data collection procedures together with the processes used to evaluate and interpret data in this study. It also explained the design of the study and the qualitative research methodology that was used.

This chapter will present the findings of the teacher and leadership questionnaires, interviews, personal anecdotes and observations conducted with principals and teachers from schools in Western Australia

This chapter is organised in the following way. Firstly, there is a general introduction followed by a section addressing the overview. Next, there is a section on methods of analysis and the reliability of the research instruments before addressing the elements of demographics and finally a section on interpreting the data.

The key questions addressed in this study are:

1. Why use ICT in Western Australian Government primary schools?
2. What are the pedagogical justifications for investing in ICT in Western Australian Government primary school?

As stated in chapter 1 section 1.5 (p. 22) to do this a series of sub questions will be investigated using a theoretical framework (The Crash Investigation model). These are detailed below.

The environment (System/schools)

3. What support structures are required to encourage teachers to make pedagogical change for the successful implementation of ICT in the classroom?

4. What school cultures are most supportive of pedagogical change for the successful implementation of ICT in the classroom?

The driver (teachers/administrators)

5. What implications does teacher attitude play in successful implementation of ICT in the classroom?

6. What role does leadership play in the successful integration of ICT into the classroom?

The vehicle (policies/applications and outcomes)

7. What skills do teachers need in order to empower them to integrate ICT effectively in the classroom?

8. What role does professional learning play in the successful integration of ICT into the classroom?

4.2 Overview and Methodology

The research methodology used to conduct this investigation was a mixed method approach utilising both quantitative and qualitative data gathering methods. Creswell, (2009, p. 4) states "mixed methods research is an approach to inquiry that combines or associates both qualitative and quantitative forms. It involves philosophical assumptions, the use of qualitative and quantitative approaches and the mixing of both approaches in a study". This part of the research design incorporated ethnographic techniques. In this study the researcher was an observer and at times a participant observer. Data was also gathered through semi structured interviews as well as personal stories and a school case study. Therefore this research used a modified case study approach which gathered data in an exploratory way, to build theory using site visits, interviews and questionnaires to understand the perspectives of those involved.

For the purposes of this study, qualitative research is non-numerical data and is used to explore and understand peoples' beliefs, experiences, attitudes, behaviours and

interactions. The information in this study has been gathered from interviews, personal anecdotes, semi and informal conversations. Quantitative research refers to the use of surveys and inventories that can generate numerical data. It should be noted that this qualitative study uses quantitative data as a way to triangulate and provide further validity to the qualitative data. Case study like data is presented to provide a deeper examination of key aspects of this research.

Figure 4 outlines the relative input for each part of the methods.

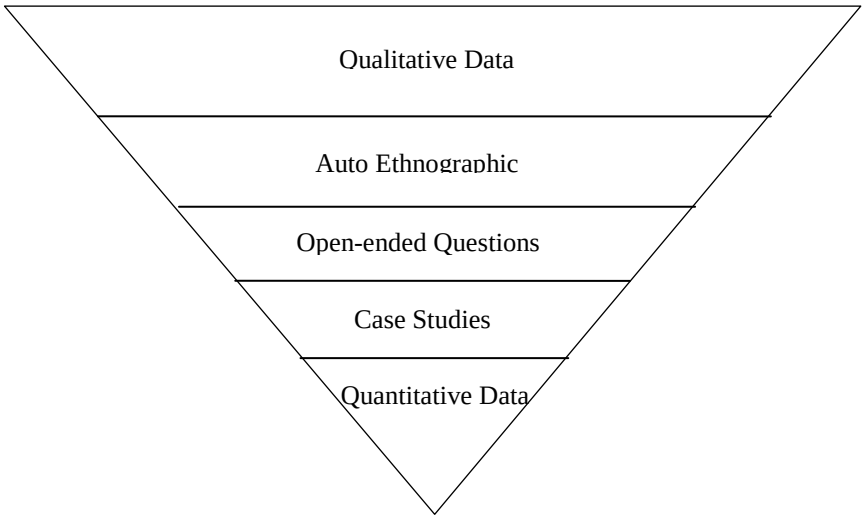

Figure 4: A graphic representation of the conceptualisation of the study

This study was designed to examine what educators in Western Australian government primary schools perceived to be the factors affecting the implementation of ICT into teaching and learning. The sample included schools randomly selected from metropolitan, remote and rural sectors in WA (Western Australia). The data for this research was collected from educators working in a cross section of government primary schools using six data collection methods comprising of questionnaires, interviews, an ICT self-evaluation guide, a making a difference matrix, anecdotal and auto ethnographic accounts, observations by a participant observer and follow up conversations with participants.

The use of various data collection methods to triangulate perspectives held by participants increased the internal validity of the research (Miles & Huberman, 1994; Yin, 1994) as information about the research was examined from six perspectives each contributing to building an overall picture about the topic in question.

The first factor examined was the teaching and learning with ICT - teacher and leadership perspective questionnaires (adapted from Department of Education & Training, 2006; Jamieson-Proctor, Finger and Watson, 2005) that identified factors related to integrating ICT into teaching and learning were used to gather quantitative data from teachers and school leaders. The questionnaires (see Appendix A & B) were designed to gather data that identified factors and perspectives of the teachers and leaders in Government primary schools.

Next, interviews and classroom observations to provide insights into classroom and teacher activity that may triangulate with the questionnaires.

Thirdly, the 'Teaching and Learning with ICT self-evaluation guide' (Department of Education & Training, 2006) and the 'Making the ICT difference' Matrix (see Appendix E) were used to gather data from staff at one school and used in the case study in order to gain a deeper understanding of the data at one particular site.

Given the limited resources for this study and the richness of the data methodology the Matrix was seen as a way to further validate what was being found by other means.

4.3 Data Gathering

Data was gathered from multiple sources; policy documents, questionnaires, interviews, classroom observations, personal stories and a school case study. In this

research multiple methods were intentionally chosen to maximise the validity and improve triangulation of the data.

4.3.1 Quantitative Data

During the data collection phase permission was granted by Western Australian Department of Education to conduct the study on Government school sites. A random selection of Western Australian primary schools were selected from a list of schools available via the schools online website (http://www.det.wa.edu.au/schoolsonline/home.do).

The researcher went through the list selecting primary schools from each letter of the alphabet, composed a list, verified their level and location, placed them in categories, and numbered each school before drawing them from a box totalling 70 schools. As a result of this process a letter of introduction, with an outline of the reasons for the research, copies of the teacher and leadership questionnaires, a request for interview and a letter of consent from the Education Department and Curtin Ethics committee, along with reply paid envelopes was posted to the 70 randomly selected primary schools.

Due to financial limitations, the researcher felt that the initial sample (180 teacher, and 100 leadership questionnaires) posted to the 70 randomly selected schools drawn from a cross section of levels and locations would provide a manageable sample if the majority of participants responded. The questionnaire package received by the school was dependent on the school's size – Level 5 & 6 schools received 5 teacher, and 2 leadership questionnaires, Level 4 received 4 teacher, and 1 leadership questionnaires and Level 3 receive one of each.

Three schools returned their package declining to take part for various reasons and the questionnaires were returned. Overall, the return rate from this initial contact was very disappointing with only 17 teacher and 5 leadership questionnaires being

completed and retuned. However, there were 3 requests for interview received from a cross section of teachers.

Due to the poor response rate a further package of similar quantities was sent out early in 2009 to a further 70 randomly selected schools of which a further 37 teacher, and 14 leadership questionnaires were returned with 10 requests for interviews. Once again the response was very disappointing and the researcher had to consider other ways in which to engage participants in the study.

As a consequence of the poor returns, a decision was made to contact various professional organisations and DoE District Education Offices requesting their support in encouraging school leaders and their teachers to participate in this research. It was decided to also create an online questionnaire using 'Survey Monkey'™ for participants to complete. This method was a little more successful. In the end after much frustration 169 teacher and 98 leadership questionnaires were received. This response equated to approximately 1.27% of the teaching population for government primary schools.

School leadership participating in the questionnaires eventually included metropolitan, urban country, rural and remote locations. Participants were drawn from six Level 6 (700+ students), 47 Level 5 (300 -699 students), 30 Level 4 (101 - 299 students) and 12 Level 3 (less than 100 students) leaders in schools. For the teacher questionnaire 11 participants came from Level 6 schools, 69 Level 5, 43 Level 4 and 28 Level 3 with 19 participants not nominating their school size and or location.

By the completion of the study, using a mail out and email (Survey Monkey™) all Government primary schools in Western Australia were contacted and asked to participate in a questionnaire, of which 169 teaching and learning and 98 Leadership questionnaires were returned.

For the case study the researcher investigated her own school because this was deemed to be convenient and time efficient. The data collection (self-evaluation guide and making a difference matrix) was already part of an ongoing assessment of the schools' ICT journey through the LwICT project. This meant that the staff was not put under any added pressure to be part of the process.

4.3.2 Qualitative Data

Interview process

A mix of data gathering techniques was employed in the interview process. Some were face-to-face while others were via telephone or email depending upon the choice of the participants and their work schedule. After receiving the questionnaire returns some participants nominated to be interviewed and or provide personal stories about their ICT journey. The participants in this study were contacted and arrangements were made with them regarding a time and suitable place for the interview to be conducted that was convenient to them. As a consequence of the time lapse between receiving the acknowledgement and conducting the interviews some participants withdrew from the process because of the timing and work commitments. Once the interviewees were sourced and their involvement confirmed an email was sent with list of guiding questions and a short introduction outlining their involvement in the interview process. A consent form request permitting the recording of the interview was also included.

Most of the interviewees found the questions a useful guide to the general area being investigated and in some cases asked for clarification about the questions as a preliminary before answering. At the conclusion of the interview process participants were given the opportunity to request a copy of the transcript for review. No such requests were received and as soon as possible after the interviews a transcript of the interview was carried out using Dragon Naturally Speaking software (http://www.australia.nuance.com) which was reasonably fast and accurate.

As part of the data collection process some teachers where approached to record their personal journeys which are included in this study.

4.4 Methods of Analysis

The structure used to analyse the data gathered from the questionnaires was based on the conceptual framework of the crash investigation model (Anthony, 2008). The reason this model was chosen to represent the data for this study was because the model used to investigate an accident scene resonated with the researcher as she struggled to make sense of the data gathered and how to present it in a uniform manner. This model is presented in figure 1 as it gave the researcher a way to systematically examine the aspects that influence teaching and learning with ICT. The crash investigation model looks at environment and for this study this represents the system and or school. The driver in this study is the teacher and or leader and the vehicle represents the application of the technology.

Table 3 represents an analysis matrix adapted from the crash investigation model and the questions to be investigated under each section.

Table 3

Conceptual Framework

Environment – system/school	**Driver – teacher/leader**	**Vehicle - application**
Question 1 – why use ICT	**Question 5 –** teachers	**Question 7 -** teacher competencies
Question 2 – ICT investment	**Question 6 –** leadership component	**Question 8 –** professional development component
Question 3 – Support & structure		
Question 4 - School Culture		

The environment addresses: research question 1 ‘Why use ICT in primary schools’; research question 2 ‘The pedagogical justification for the investment into ICT’; research question 3 ’The support and structures required for teachers to integrate ICT’; and research question 4 ‘The school cultures that support change and ICT implementation’.

The driver addresses research questions 5 ‘What implications does teacher attitude play?’ and research question 6 related to the role leadership plays in implementing ICT.

The vehicle addresses research question 7 about the skills teachers need to integrate ICT into teaching and learning and the aspect of professional learning in research question 8.

4.5 Reliability of Research Instrument

The reliability of the research instrument was determined by calculating Cronbach’s alpha reliability coefficient for each scale within a given instrument where scales were deemed to be present. The coefficient determines the degree of reliability between the answers to a group of questions that address a common theme. That is, the Alpha coefficient ranges in value from 0 to 1 and may be used to describe the reliability of factors extracted from dichotomous (that is, questions with two possible answers) and/or multi-point formatted questionnaires or scales (i.e., rating scale: 1 = poor, 5 = excellent) as used in this study. The higher the score, the more reliable the generated scale is (Sentos, 1999). Therefore, the computation of alpha is based on the reliability of a test relative to other tests with same number of items, and measuring the same construct of interest (Sentos, 1999). Generally this coefficient will be between 0 and 1, although Marcus & Nichols (1999) has described a situation in which a negative value can occur. The data can be considered more reliable the closer the calculated coefficient approaches 1.

Reliability of classroom observation and interviews was conducted by checking transcripts to make sure that they do not contain obvious mistakes made during transcription. The triangulation of data gathered through the various activities (classroom observation, interviews and personal journeys) was used to validate data and perspectives of participants. The use of member checking to determine the accuracy of the data was carried out by taking the findings back to the participants and checking whether they felt the findings were accurate. This process adds validity to the study (Creswell, 2009).

This section reports on the demographics of the Western Australian government schools surveyed and using a conceptual framework that looks at the elements related to 'the environment'. Under this section the researcher is looking at the system and/or school. In the next section 'the driver' the researcher looks at the leader and/or teacher and in the final section 'the vehicle' the researcher looks at the application and/or achieving outcomes.

4.6 Demographics

The Department of Education in Western Australia is the biggest employer of teachers in the state (Department of Training & Workforce Development, 2010). It covers the whole of Western Australia and employs over 13,000 teachers and principals in 720 primary schools. These schools are located in the metropolitan area, large country towns, rural and remote locations and are classified as level 6 (more than 700 plus students), level 5 (300 – 699 students), level 4 (101 – 299 students) and level 3 (less than 100 students.

Figure 5 depicts the demographics of the participants in the teacher and leadership questionnaires.

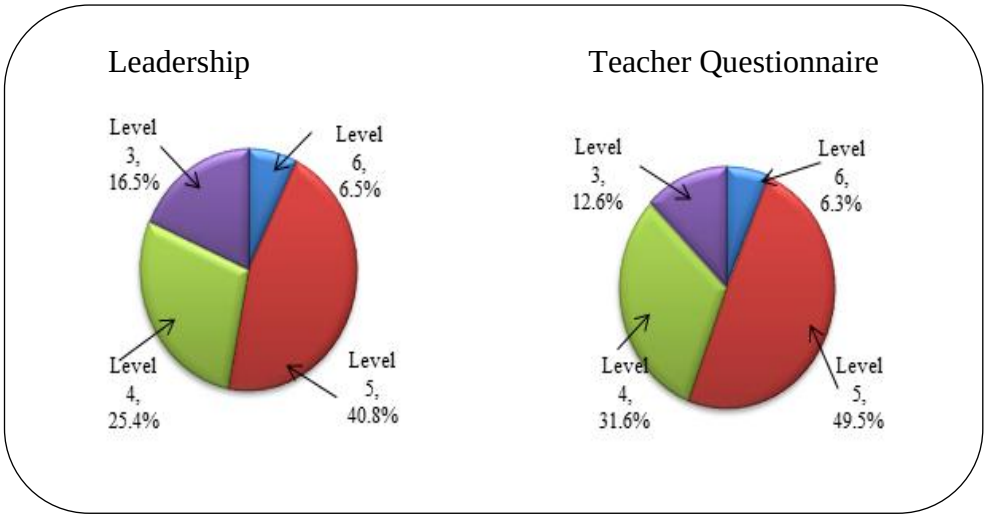

Figure 5: The demographics of the participants for the teacher and leadership questionnaires

4.7 Interpreting Data

For this study caution should be exercised when considering any data analysis because the response group is limited. For this study only one hundred and sixty nine teachers and ninety eight leaders responded to the questionnaires. The participants who used Survey Monkey™ to respond to the questionnaire appear to have a positive outlook on using technology, as did the majority of participants who completed the pen and paper questionnaire as they held similar views. The lack of response from the primary sector as a whole could be attributed to many factors such as lack of time, work overload and commitments, lack of interest or confidence with the technology.

In representing quantitative data a mix of tables and charts where used. In the pie charts each segment represents the percentage of responses made by each category. In the bar charts, the vertical axis represents the number of responses to the question and the horizontal axis represents the variable. In figure 3, the number of schools who agreed to participate is represented on the vertical axis and the school level is the variable on the horizontal axis.

The following section is divided into three areas. Part A looks at the classroom perspective as pertaining to the view of teachers and leaders across Western Australian schools. Part B looks at the leadership perspective whilst Part C investigates the integration of ICT at the grassroots level at one school and Part D investigates the individual teacher's perspectives. The case study data for the participant observer perspective was conducted at the researchers own school.

4.8 Part A: The Classroom Practitioners Perspective

The teaching and learning with ICT in the primary classroom questionnaire was designed to collect information on the demographics of classroom practitioners and to seek their views on a range of matters relating to ICT integration into teaching and learning, in particular in the following areas:

- The school's capacity to implement ICT;
- Assessment of professional learning offered and undertaken to enhance schools and knowledge;
- School planning and leadership;
- Attitudes towards ICT;
- Beliefs about ICT integration into teaching and learning;
- The integration of ICT into teaching and learning;
- School capacity to support ICT integration;
- Application of ICT in the classroom;
- Leadership, teaching and curriculum;
- Achieving outcomes';
- Assessing student outcomes with ICT;
- Professional use of ICT/knowledge/practice/values and relationships.

4.8.1 Demographics

For this study 40 pen and paper questionnaires were received from a range of schools and 129 questionnaires were collected via Survey Monkey giving a total of 169 participants of which 161 contained valid and useful data. The participants were from a range of locations and school classifications with the majority of responses coming from Level 5 Metropolitan schools.

Figure 6 represents the percentage of schools and their levels participating in the teacher questionnaire.

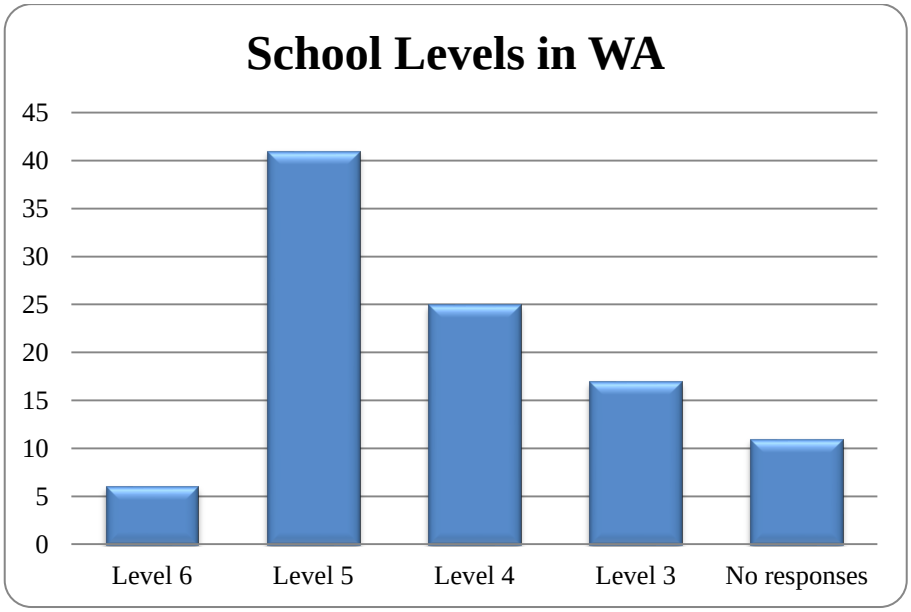

Figure 6 The percentage of participating schools and their levels

Table 4 shows a location frequency distribution with 4 categories of location range defined. It compares data from this study with the overall teaching population and the data gathered from the Departments 'teacher ICT skills survey conducted in 2005'.

In the Department of Education (DoE) Western Australia (WA) the schools are classified into levels. Level 6 is the highest primary school level and this is a school

that has more than 700 students enrolled from K - 7. A level 5 school has an enrolment of 300 - 699 students from K - 7, Level 4 has an enrolment of 101 -299 students from K - 7 and Level 3 has an enrolment of less than 100 students from K - 7. (K in WA is Kindergarten and the students must turn 4 before June 30 to attend).

Each school within the WA DoE system has a principal. In some small Level 4 schools and all Level 3s the Principal has a teaching component. Deputy Principals, also known as Associates or Assistant Principals, have a teaching component as part of their duties; however, this can be dependent on their school's staffing structure and is at the discretion of the Principal.

The majority of respondents (41%) in this study came from level 5 schools followed by 25% from Level 4 and 17% from Level 3 schools.

Whilst 61% of the respondents in the survey indicated they were currently located in a metropolitan school there was a mix of country, rural and remote schools represented in this study.

In this study 76% of respondents were female and 68% held a teaching role, which is not surprising considering the majority of teachers employed in Western Australian primary schools are female.

Table 4

Sample characteristics

	Total n=161	All Primary teacher n= 13 312(2010)	DoE study respondents n=1 500	All DoE Teachers n=18 225(2005)
Location				
Metropolitan	61	n/a	66	66
Rural	31	n/a	34	34
remote	3	n/a	n/a	n/a
No response	5			
Classification				
Level 6	6	3	n/a	n/a
Level 5	41	39	n/a	n/a
Level 4	25	33	n/a	n/a
Level 3	17	24	n/a	n/a
No response	11			
Role				
Administrators Principal & Associate	7	n/a	8	13
Teacher	88	n/a	92	87
Specialist				
Ed Support				
Other				
No Response	5			
Gender				
Male	19	16	28	25
Female	76	84	72	75
Age				
<24	2	3	5	4
25 -29	18	11	12	10
30 -39	14	19	22	22
40-49	32	25	32	31
50 -59	28	30	29	33
60 -69	3	7		
70		0.1		
Employment Status				
Permanent	76	75	69	73
On probation	4	0.3	6	26
Fixed term/casual	15	24	24	
No response	6			
Mode of employment				
Full time	78	65	73	71
Part –time	11	34	27	29
Job-share	5			
No response	6			
Years of service				
<1	3	7	8	n/a
2-3	13	8	9	n/a
4-5	9	6	1	n/a
6-9	14	14	14	n/a
10 -19	20	64	27	n/a
20+	37		32	n/a

Note: 61% primary school and 39% secondary teacher populations made up the Teacher ICT Skills data in 2005

In the next section the following elements were examined:

School capacity

This first section examines the ICT Resources available in the school and to what extent they are being utilised. Next it examines the availability of professional learning and what is on offer in the school setting, did the school provide the professional learning and was it accessed. Finally looking at school leadership and planning.

Attitudes and beliefs about ICT in teaching and learning

Section two examines participants' attitude towards ICT and their belief about integrating ICT into their teaching and learning. For this study attitude is defined as how a person thinks, what they do and how they feel and a belief is the presumed truth about a situation.

Application in teaching and learning

Section three presents data on how respondents apply their knowledge, skills and understanding of ICT integration into teaching and learning. This includes the school's capacity to support ICT integration, professional use, knowledge, practice, values and relationships in the integration of ICT into teaching and learning in primary classrooms.

4.8.2 School Capacity - ICT Resourcing in Primary Schools

Research shows strong relationships between the ways in which ICT is being used and the resulting attainment outcomes (Fraser, 2005; Khine, 2005). This suggests that a crucial component in the use of ICT within education is the teacher and their pedagogical approaches. Teachers learn how to use ICTs more effectively when they see the technologies not as generic and decontextualized tools but as tools for

teaching, that is, for motivating, managing, facilitating, enhancing, and evaluating learning (Otero, Peressini, Meymaris, Ford, Garvin, Harlow… & Mears, 2005). Teachers also need 'to see a direct link between technology and the curriculum for which they are responsible' (Carlson & Gadio 2002, p. 122). Excellent software, reliable hardware and resilient networks, important though they may be, will have no effect on the attainment if teachers are not able to educate the use of these resources appropriately (Cox et al., 2004).

The questionnaire used in this study asked participants to indicate the availability of ICT resources in their school and if they had used these resources as part of their professional duties in teaching and learning. The resources indicated were

- PC/laptop for personal use
- Notebook for teacher
- Printers
- Digital cameras
- Specialist software – CAD, HTLM (FrontPage)
- Internet
- Technical support
- Data projectors
- PC for students
- Laptops for students
- Interactive white-boards (IWBs)

In table 5 respondents were asked to indicate which of the following ICT resources are available in their school and if they had used these resources.

Table 5

Schools ICT capacity - availability and use

	Available %	Used them %
PC/laptop for personal use	78.0	59.0
notebook for teachers	90.0	67.0
SIS	90.0	67.0
email	91.0	72.0
intranet	79.0	61.0
internet	92.0	71.0
printers	93.0	75.0
digital cameras	90.0	72.0
specialist software	37.0	21.0
technical support	73.0	54.0
data projectors	86.0	56.0
PC for students	86.0	64.0
laptop for students	42.0	26.0
IWBs	68.0	46.0

n=161

Findings for school's ICT capacity - availability and use

All the resources identified in table 5 were available in the schools to some degree. The most commonly available resources to participants were: internet 92% availability with 72% usage, printers – 93% availability and 75% usage and digital cameras – 90% availability and 72% usage. This suggests if the hardware is available and teachers feel comfortable in its use, they will integrate technology into their teaching and learning.

Regarding computers for personal use, 90% of the participants indicated the notebook for teachers program and 81% indicated PCs/desktops were available; however, only 67% of participants used the notebook for teachers program and 57% use the PCs/desktop computers available to them.

There were also a significant number (86%) who indicated data projectors were available but only 56% of participants used them and 68% indicated Interactive Whiteboards (IWB) were available however, only 46% have used these.

Therefore, it can be noted from this research data that ICT resourcing does not seem to be a barrier in the respondent's schools. ICT is available but a teacher's decisions on whether to utilise what is available may be the issue. One aspect that needs to be investigated is the ease of access to these resources and professional learning and links to why ICT is not fully utilised by participants.

4:8.2 Access to Professional Learning

Professional learning plays an important part in developing a person's confidence and competence in implementing a strategy (Ertmer et al., 1999). It needs to be targeted to match the needs of the learner and provide schools and tools to create or progress towards individualised, student-centred, collaborative learning and promote teacher – student interactions (Bransford, Brown & Cocking, 1999; McKenzie, 1991). This section looks at the area of professional learning and how participants gained their ICT skills and knowledge.

Participants were asked to indicate whether they had undertaken professional learning in any of the following areas and was it arranged by the school.

The areas were:

- Training in the use of computers/basic computing
- SIS Curriculum Manager
- Word processing – MS Word
- Spread sheets – Excel
- Presentation software – PowerPoint/Producer
- Database – Access
- Publishing – Publisher
- Movie making – Photo- story/Movie maker

- Web search – Internet
- Email – Web-mail/Outlook
- Thinking Tools – Inspiration/Kidspiration
- Training on how to integrate ICT into Teaching and Learning
- Digital Cameras
- Interactive Whiteboards

In table 6 the respondents were asked to specify if they have undertaken professional learning in any of the 14 areas indicated and whether this professional learning had been organised by the school.

Table 6

ICT Professional Learning

	Yes %	**No %**	**Self-taught %**	**Arranged by school %**
Basic computing	53.0	7.0	35.0	31.0
SIS	77.0	9.0	8.0	73.0
Word Processing	30.0	15.0	54.0	23.0
Spread sheets	21.0	35.0	41.0	43.0
Presentation software	33.0	20.0	47.0	11.0
Database software	15.0	62.0	13.0	24.0
Publishing	21.0	30.0	45.0	42.0
Movie making	32.0	36.0	25.0	11.0
Web searching	30.0	17.0	50.0	20.0
Email	33.0	15.0	48.0	35.0
Thinking tools	32.0	43.0	18.0	29.0
Integrating ICT into curriculum	61.0	23.0	12.0	31.0
Digital cameras	30.0	19.0	49.0	40.0
Interactive whiteboards	62.0	23.0	15.0	34.0

Findings for professional learning accessed and undertaken

It is interesting to note the percentage of participants who indicated the majority of their ICT skills and knowledge were self-taught and the schools mainly concentrated on providing professional learning in those areas that linked directly to the overall operations of the school. For example SIS was the highest offered professional

learning opportunity present to the participants whilst applications like presentation software and Movie- maker where the least offered PL opportunities.

Minimal professional learning opportunities were provided in areas of presentation software (11%), movie making (11%), Web searching (20%), Databases (24%), word processing (23%), thinking tools (29%) and integrating ICT into teaching and learning (31%).

The least number of participants (28%) undertook Professional Learning in databases either through direct course training or self-instruction.

Professional learning arranged by schools was most likely to be arranged in the area of SIS Curriculum Management (73%) followed by spread sheets (43%), publisher (42%) and digital cameras (40%)

The courses least likely to be organised by the school were presentation software – PowerPoint/Producer (11%) and Movie Maker/Photo-story (11%)

In conclusion, the majority of the participants surveyed in this study indicated their ICT skills and knowledge were mainly gained through self-instruction. This is an important outcome and may be linked to the need to ensure teachers have access to good technology at home.

4.8.3 School Planning and Leadership

According to McKinsey (2007) school reform rarely succeeds without effective leadership at both the system level and the school level without sustained, committed and talented leadership.

In this section participants were asked to: indicate the extent to which they would agree or disagree with each statement in regard to the use of ICT at school.

- My school has a clear sense of direction in how to use ICT to enhance the learning of students.
- My school encourages the use of ICT by all teachers and puts support strategies in place for everyone.
- The use of ICT is encouraged in the teaching and learning of students at my school and appropriate access and support is provided.
- Teachers at my school are encouraged and supported in participating in professional ICT learning opportunities.
- ICT is used to monitor, evaluate and report on student achievement at my school.
- Sufficient IT resources are available to make the ICT requirements of teachers and students.

Some of the items have been analysed as a scale because they are deemed to be like items after consultation with participants and inter item analysis of discriminant validity and Cronbach's alpha coefficient. The statistical analysis confirms the use of items as a scale as both the frequency analysis and Cronbach's Alpha reliability show high levels of agreement in participant responses to the items. To find the reliability for the different items SPSS 13.0™ was used and even though it was only a small sample Cronbach's Alpha reliability was high. In the case of school planning and leadership Cronbach's Alpha was 0.94 for the 6 items. The item mean was 2.38 and Cronbach's alpha of items were deleted and ranged from 0.91 – 0.94 indicating that no single item would significantly reduce scale reliability.

Table 7 shows participant responses that indicate the degree to which they agree or disagree with the 6 statements above.

Table 7

School planning and leadership

	strongly agree %	agree %	neutral %	disagree %	strongly disagree %
Clear ICT direction	25	35	20	9	3
Strategic ICT support	34	34	14	9	2
Encourages use of ICT	30	41	87	11	2
Supports PL	25	39	19	8	1
Monitor student achievement	24	50	12	5	1
Sufficient ICT resources	11	26	16	31	8

n=161

Findings for school planning and leadership

Overall there was a positive response to all statements in this section with between 60% to 74% of the participants either strongly agreeing or agreeing to each statement except for the last statement about sufficient IT resources being available to meet the ICT requirements of teachers and students whereby 39% plus 16% were undecided, either disagreed or strongly disagree with this statement. This suggests that schools have ICT planning and leadership in place but the element that appears to be hindering the implementation of ICT into teaching and learning is that of insufficient ICT resources.

The statement 'the use of ICT is encouraged in the teaching and learning of students at my school and appropriate access and support is provided', 71% of the participants strongly agree or agree that ICT is encouraged and appropriate access and support is available in these schools. However, in the statement 'sufficient IT resources are available to meet the ICT requirements of teachers and students', 39% strongly disagree or disagree there are sufficient resources in their school to meet requirements.

When teachers were asked if they were encouraged and supported in participating in professional ICT learning opportunities 64% strongly agreed or agree that professional learning is encouraged and supported by their school.

For the statement ‘sufficient IT resources are available to meet the ICT requirements of teachers and students’ was still considered by many to be under resourced. 39% either disagreed or strongly disagree with 16% undecided; however, 37% strongly agree or agree to having sufficient ICT resources available to meet requirements. This suggests that ICT resourcing is still considered an obstacle and therefore, one of the reasons why teachers are not integrating ICT effectively into their teaching and learning.

The most positive statement ‘ICT is used to monitor, evaluate and report on student achievement at their school using ICT’ had 74% of the participants strongly agree or agree with this statement with 6% either disagreeing or strongly disagreeing.

4.8.4 Attitude toward ICT

Research literature has indicated teaching and learning can be improved by the use of technology, but it is not the only solution (Gaynor, 2004). It is important to consider the attitude of the educator towards ICT and its benefits in the classroom as this will affect the implementation of this tool in their teaching and learning (Ertmer et al., 1999).

To gain a deeper understanding of participants’ attitude (think, do feel) towards the implementation of ICT into teaching and learning they were asked to indicate the extent to which they agree or disagree with each of the statements about ICT:

- ICT has no place in primary school teaching and learning programs;
- ICT provides primary teachers with suitable backup and extension material for students, indicating a still strong perception of ICT as an ‘add on’ or reward rather than integral to their core teaching;
- ICT is ‘time consuming’ or presents teachers with difficulties related to storage of hardware and or software and faults in equipment;
- ICT in primary school is still an additional component rather than an integral element in the delivery of the curriculum;

- The integration of ICT within the curriculum is a goal. However, there is still a tendency to focus on 'teaching ICT' rather than 'teaching with ICT';
- Students use of ICT has the capacity to strongly support student-centred, inquiry based learning;
- ICT provides valuable resources and tools to support student learning;
- ICT has limited capacity to provide benefits in the classroom;
- I like the challenge of exploring technology and new software and its possibilities;
- ICT is a useful resource in supporting my teaching and learning program;
- The use of ICT in the teaching and learning program can empower all students.

Table 8 on the next page presents data about the degree to which participants agree or disagree with the statements in regards to their attitude towards ICT and Table 9 examines the classroom teachers' responses to their attitudes towards ICT.

When analysing the data for all the responses to the question about teachers' attitude towards ICT, the Cronbach's Alpha reliability was 0.93 which is considered to be high, and a scale mean of 2.96. However, when examining only the classroom teachers' responses the Cronbach's Alpha reliability was 0.84**.** Compared to the whole sample and the teachers' scale, the mean was 2.20 indicating that overall the classroom teachers' responses were less positive. The statistical analysis confers this as both Cronbach's Alpha reliability and frequency distributions show high levels of agreement between the participants' responses and the item.

Table 8

Attitudes towards ICT

	strongly agree %	agree %	neutral %	disagree %	strongly disagree %
ICT has not place	2	0	1	20	67
Is time consuming	8	43	7	23	10
Limited benefit	3	20	9	29	30
An add-on or reward	5	16	18	35	16
Not integral to teaching and learning	4	34	8	30	14
ICT teaching rather not teaching with	9	45	11	20	5
Useful resource	46	38	5	2	0
Supports inquiry based learning	51	34	5	1	0
Empowers all students	50	33	7	1	0
Valuable resource to support learning	53	34	3	1	0
Like the challenge of exploring	37	34	15	4	0

n=161

Table 9

Classroom teachers' attitudes towards ICT

	strongly agree %	agree %	neutral %	disagree %	strongly disagree %
ICT has not place	2	0	1	21	65
Is time consuming	7	41	5	25	11
Has limited benefit in the classroom	1	7	4	40	36
ICT is an add-on or reward	4	16	15	38	16
ICT is an add on not integral	3	34	8	32	12
focus on ICT teaching not teaching with	7	49	9	20	3
ICT is a useful resource	42	39	7	2	0
ICT supports inquiry based learning	49	35	5	0	0
ICT can empower all students	47	35	7	1	0
ICT is a valuable resource to support learning	52	36	0	0	0
Like the challenge of exploring technology	34	35	15	5	0

n=122

Findings for attitude toward ICT

As teacher attitudes toward ICT affects their motivation to learn and integrate ICT into their teaching and learning it is important to understand teacher's attitude towards ICT. On a whole teachers' attitudes toward ICT in primary school was very positive with 67% strongly agreeing that ICT does have a role to play in primary school education. There were, however, 3% of the participants who felt ICT did not have a place in primary school.

For the question asking whether ICT provides primary teachers with suitable backup and extension material for students, indicating a perception remains. That ICT is an add on or reward rather than integral to their core teaching, 41% of the same respondents disagree or strongly disagree with this statement and 21% strongly agree or agree and 18% were unsure.

On the question of ICT being time consuming or presenting teachers with difficulties relating to the shortage of hardware and or software and faults in equipment 51% of the participants strongly agree or agree with this statement.

In regard to the following statements: ICT has no place in primary school, it is time consuming or presents teachers with difficulties and ICT has limited capacity to provide benefits in the classroom, there were mixed responses with 87% of the respondents strongly disagree or disagree with the statement that ICT has no place in primary school**.** However, 51% either agree or strongly agree that ICT is time consuming or presents teachers with difficulties while 59% strongly disagree or disagree that ICT has limited capacity to provide benefits in the classroom. This suggests further investigation is needed to explore the statement about ICT being time consuming or posing difficulties to teachers so as to tease out what is meant by this.

Overall the respondent's attitudes towards ICT were very positive.

The least positive statement, 'ICT has no place in primary school' attracted disagreement or strong disagreement of 87% of respondents. The statement ICT has limited benefit in the classroom attracted disagreement\strong disagreement of 59%. This statement that ICT is time consuming or presents teachers with difficulties showed a reverse with 51% either agreeing or strongly agreeing to this statement with 33% disagreeing or strongly disagreeing and 7% were unsure. What this

suggests is that the participants in this study held a strong positive view about the place of ICT in primary school.

The statement 'I like the challenge of exploring technology and its possibilities' showed an encouraging trend with 71% of respondents from this study indicating they agree or strongly agree with this statement.

This study has found for teaching and learning with ICT to be successfully integrated, schools need a vision, and a positive school culture whereby teachers and leaders work together to support and encourage each other as they integrate new technologies into everyday practices. This is supported by the research literature (Osteri, et al., 2005; Pegg, Reading & Williams, 2007; Trinidad, 2005; Vrasidas & Kyriakou, 2008). These researchers indicate that the requirements for a successful pedagogical framework are:

- An awareness of the availability of ICT resources that will contribute to the lesson process;
- An ability to use a variety of ICT resources in a range of contexts;
- Curriculum expertise;
- A depth of knowledge of the use of ICT;
- An ability to challenge understandings, thinking and reflection;
- An ability to organise and manage a class to suit a variety of contexts and opportunities.

4.8.5 Belief about ICT

- To gain a deeper understanding of participants' beliefs about ICT integration into teaching and learning they were asked to indicate the extent to which they agree or disagree to the following statements:
- Teachers are becoming increasingly aware of ICT; some have attended training, but often lack the confidence; as a consequence they are reluctant to use it in their classroom teaching and learning program;

- Teachers are increasingly aware of the benefits of technology and beginning to incorporate ICT into teaching often replacing former activities with ICT alternatives; as a consequence this is having a beneficial effect on the teaching and learning outcomes;
- Teachers are becoming increasingly familiar with appropriate use of ICT and can integrate it into many aspects of their ongoing teaching; as a consequence teaching and learning is becoming significantly enhanced;
- The potential of ICT is now exploited to enable approaches which could not be easily replicated by traditional means; as a consequence teaching and learning begins to be significantly transformed;
- In primary school, without a dedicated computing department, many teachers feel that they must focus on the development of pupils' ICT skills before they can gain maximum benefit from the resources.

Table 10 depicts the responses to the five statements above in regard to their beliefs about ICT integration into teaching and learning. Table 11 examines only the classroom teachers' responses to the statements on beliefs about ICT integration into teaching and learning.

Table 10

Beliefs about ICT integration into teaching and learning

	strongly agree %	**agree %**	**neutral %**	**disagree %**	**strongly disagree %**
Aware but lack confidence	22	56	8	4	1
Beneficial to teaching and learning	9	61	17	3	1
ICT significantly enhances	10	50	18	12	1
ICT transforms teaching /learning	7	43	29	11	1
Need an ICT teacher	10	49	18	11	3

n=161

Table 11

Classroom teachers' beliefs about ICT integration into teaching and learning

	strongly agree %	agree %	neutral %	disagree %	strongly disagree %
Teachers are aware but lack confidence and reluctant to use	18	63	10	3	2
ICT - a beneficial effect on teaching and learning	8	65	18	4	1
ICT significantly enhances teaching and learning	10	56	19	11	1
ICT transforms teaching and learning	5	43	35	11	2
Need a dedicated ICT teacher	8	51	21	12	3

n=122

For the statements on beliefs about ICT integration into teaching and learning Cronbach's Alpha reliability for belief about ICT was 0.87 for the 5 items when examined as a scale and the scale mean was 2.48. Cronbach's Alpha reliability was 0.84 and the scale means was 2.49 for the classroom teacher's responses. This indicates the classroom teachers were slightly more positive in their beliefs about ICT integration than the sample as a whole. It is interesting to note that even with a relatively small sample size for this section of the data collection, reliabilities were still high.

Findings for beliefs about ICT integration into teaching and learning

A large group of respondents from the survey (78%) held the belief that teachers are becoming increasingly aware of ICT; however still lack the confidence to use it in their teaching and learning. This is a key outcome in the literature that is paralleled in this study.

In this study, teachers are aware of the benefits ICT with 70% stating they are beginning to replace former activities with ICT alternatives. While 64% acknowledge that teachers are familiar with appropriate use of ICT and can integrate it into many aspects of their teaching. However, only 50% believe that the potential

of ICT has been exploited to enable approaches which could not be easily replicated by traditional means.

In this study 50% of the respondents stated many teachers feel they must focus on developing student's ICT skills before they can maximize benefits from the resource. While 14% strongly disagree or agree with this view and 18% were unsure.

4.8.6 Integrating ICT into teaching and learning

Learning with ICT offers students a world of opportunities, and global communications with peers, communities and experts; access to timely and relevant information and engagement in rich, relevant tasks based on real world experiences (Curriculum Council, 2005).

The previous sections have explored the respondent's attitudes and beliefs about ICT. This section examines the extent to which respondent's ICT skills and knowledge are applied in teaching and learning. Respondents were asked to indicate the extent to which they have students:

- Compare materials presented in different media;
- Read stories or other text on the computer;
- Use the computer to write stories or other text;
- Use the computer to communicate with or undertake projects with students in other schools or countries;
- Watch movies, videos, or television to obtain information;
- Read instructions and/or do reading activities on the Internet;
- Read instruction and/or do reading using Computer Software;
- Use Computer Technology to find information;
- Play games on the computer;
- Use a computer at school.

Table 12 on the next page addresses the responses to the above statements regarding the extent to which teachers integrate ICT into their teaching and learning.

For the statements about integrating ICT into teaching and learning Cronbach's Alpha reliability is 0.93 for the whole group with an item mean of 2.96. When an examination was carried out on only the classroom teachers' responses Cronbach's Alpha reliability was 0.92 with an item mean of 2.84. This indicated overall the classroom teachers' responses were very similar to the whole sample.

Table 12

Integrating ICT into teaching and learning

	frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Compare materials	15	15	37	19	5
Read stories/text digitally	20	30	22	15	3
Compose stories/text digitally	18	25	35	8	4
Communicate with others	7	7	10	20	52
Read using computer software	10	18	32	19	10
Find information	28	38	16	4	3
Play games	12	14	43	15	6
Use computers at school	45	27	15	2	1
Watch movies	12	17	46	10	9
Read from the internet	14	23	34	14	9

n=161

Table 13

Classroom teachers' response integrating ICT into teaching and learning

	frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Compare materials	14	13	41	22	5
Read stories/text	18	32	25	19	2
Compose stories/text	17	29	39	10	1
Communicate with others digitally	7	6	8	21	53
Read using computer software	11	16	38	25	7
Use ICT to find information	29	42	21	3	1
Play games	16	16	46	14	5
Use computers at school	44	33	17	1	0
Watch movies	15	16	50	11	4
Read from the internet	16	20	38	16	7

n=122

Findings for integrating ICT into teaching and learning

Even though in the previous sections respondents had a positive attitude and belief about ICT in teaching and learning, in this section response is less than positive with the majority of participants indicating they integrate and/or use ICT in their teaching and learning sometimes. With the exception of using computers to find information, 67% of the respondents stated they do this frequently, if not often.

In this study the area least integrated into teaching and learning is communicating/doing projects with other schools or countries with 52% of the respondents having indicated they never did this with their students.

This aspect of integration needs to be investigated further to gain a greater understanding as to why the participants did not use the technology for this purpose.

One reason why teaching and learning with ICT is not happening in our schools could be the issue of access which has been mentioned in previous sections as a concern by participants. According to Gaynor, (2004) and Bingimals, (2009) the key factors to successful integration are:

- The subject knowledge of the teacher;
- The pedagogical knowledge of the teacher;
- The access to resources by teachers and students;
- Attitudes, awareness and confidence;
- The use of collaborative practice;
- Curriculum and innovative leadership;
- The ability to integrate ICT that supports, enhances and exploits other teaching and learning opportunities; and
- Planning

Findings of this study would suggest that even though schools have the hardware and software to enable effective teaching and learning with ICT many teachers seem to struggle with best practice when it comes to integrating ICT. On the whole teachers use ICT for low level tasks and have not as yet ventured into using the technology to open up the student's world by communicating with others.

4.8.7 School Capacity to Support

The school's capacity to support the integration of ICT can have an impact on how well practitioners implement the strategy into their teaching and learning. To understand what factors influence the respondent's use of ICT they were asked to indicate their position on each of the following in relation to the school support for ICT integration:

- Is your school's capacity to provide integration hindered by the shortage or inadequacy of the computers for instruction;
- Is your school's capacity to provide integration hindered by the shortage or inadequacy of Computer software for instruction;
- Is your school's capacity to provide integration hindered by the shortage or inadequacy of audio-visual resources for instruction;
- Is ICT a priority in your school;
- Is ICT part of your teaching and learning;
- Do you make ICT an integrated part of your teaching and learning;
- Is there a school budget for the implementation of ICT in the school plan;
- Do you feel confident in integrating ICT into your teaching and learning?

Table 14 on the next page depicts the responses given by all the participants for the questions regarding the barriers influencing the school's capacity to support ICT integration. Table 15 represents the responses given by only the classroom teachers participating in this questionnaire. It is interesting to note the overall response from the teachers was very similar to that given by the whole group which includes other staff members such as the leadership team and specialist teachers in the school.

For the statements about school capacity to support ICT integration Cronbach's Alpha reliability is 0.91 for the whole group with a scale mean of 2.90. When an analysis was carried out on only the classroom teachers' responses Cronbach's Alpha reliability was 0.92 with a scale mean of 2.84. This indicating that overall scale means for the classroom teachers' responses was very similar to the whole sample.

Table 14

School capacity to support ICT integration

	Yes %	No %	Don't know %
Shortage of computers	52	37	1
Shortage of software	34	51	4
Inadequate audio visual	40	41	6
A priority	68	16	5
Part of your teaching and learning	85	4	1
An integrated into your classroom practice	75	12	2
Budgeted as part of the school plan	79	3	8
Feel confident in integrating into Teaching and learning	71	14	3

n=161

Table 15

Classroom teachers' responses to their schools capacity to support ICT

	Yes %	No %	Don't know %
Shortage of computers	55	39	1
Shortage of software	37	52	5
Inadequate audio visual	38	46	9
A priority	74	16	7
Part of your teaching and learning	93	2	1
An integrated into your classroom practice	79	13	3
Budgeted as part of the school plan	83	2	10
Feel confident in integrating into Teaching and learning	70	20	5

n=122

Findings for school capacity to support ICT integration

These results demonstrate that perceived barriers (shortage of computers, software, inadequate audio visual resources, budget allocation and lack of confidence) to the use of ICT in the classroom are not fully supported by this research. However, 57%

of the respondents to this survey compared to 37% of respondents do feel there is a shortage of computers in their school.

On a positive note, 68% of participants report their school has ICT as a priority compared to 16% who don't. While 75% compared to 12% indicated they integrate ICT into their teaching and learning and 71% compared to 14% feel confident in this integration.

4.8.8 Application of ICT in the Classroom

The following discussion examines the extent to which the respondents apply skills, knowledge and understanding of ICT integration into their teaching and learning practice.

Respondents were asked to examine the list of statements about the extent to which they apply ICT into their teaching practice then choose one description that best describes the situation.

Table 16 presents the responses given by participants to the question about what the impact ICT is having in their classrooms. It can be noted that the responses given by the classroom teachers' were varied and this may indicate the teachers themselves held a more accurate assessment of what they perceived as being the true status of ICT application in the classroom.

Table 16

Application of ICT in the classroom

	Whole sample %	Classroom teacher %
Extensive impact on what students learn	32	29
Useful resource impacting on the curriculum	42	47
Improving student skills	14	16
Little impact on student learning	4	2
Not applicable to my role	4	2
No Response	6	4
	n=161	n=122

Findings for the overall integration within teaching and learning

As illustrated in figure 7 when participants were asked to what extent they apply ICT within their teaching practice the following responses were given.

Over 74% of the respondents selected the two responses, extensive impact on what students learn and a useful resource, as showing a high level of integration, with 42% of the respondents indicating that in their teaching and learning ICT was a useful resource impacting on some of the areas of the curriculum, 32% indicated ICT was having an extensive impact on what students learnt and how they learn. However, 20% indicated ICT was having little or no impact on the teaching and learning and 11% did not respond to this question.

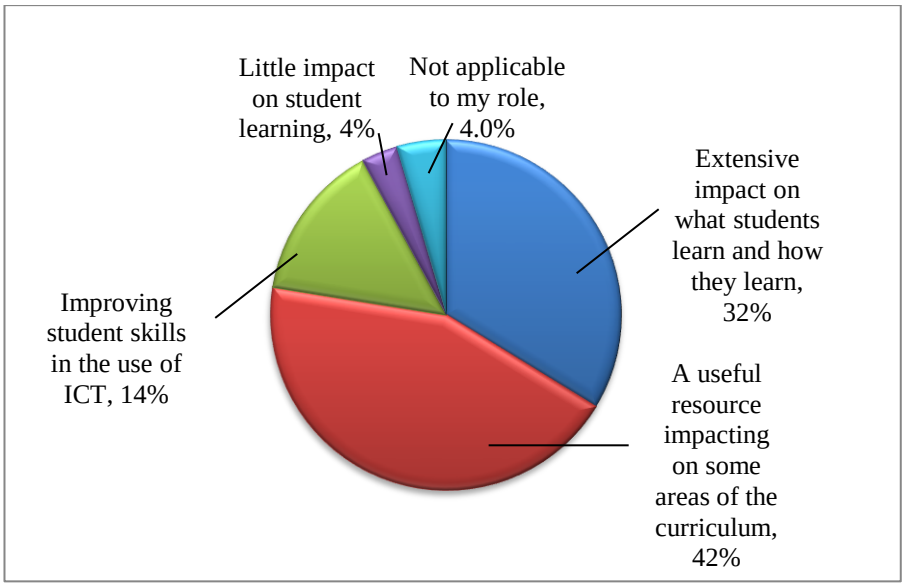

Figure 7: Integration of ICT into teaching and learning

4.8.9 Teaching, Learning and the Curriculum

In this section of the questionnaire respondents were asked to indicate the current situation in their teaching context in regard to students and class use of ICT to:

- Engage in independent learning through access to education at a time, place and pace of their own choosing;
- Provide motivation for curriculum task;
- Develop deep understanding about a topic of interest relevant to the curriculum area being studied;
- Acquire awareness of the global implications of ICT based technologies on society;
- Engage in sustained involvement in long-term projects;

For the statements about teaching, learning and the curriculum Cronbach's Alpha reliability is 0.91 for the whole group with an item mean of 3.16. When an analysis was carried out on only the classroom teachers' responses Cronbach's Alpha reliability was 0.88 with an item mean of 3.19. Indicating that overall the item means for the classroom teachers' responses were slightly higher than the whole sample.

Table 17 and 18 present the responses given for the five statements above about teaching, learning and the curriculum.

Table 17

Teaching, Learning and the Curriculum

	frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Engage in independent learning	14	19	34	16	10
Provide motivation	22	34	27	8	2
Develop deep understandings	20	24	37	10	2
Awareness of the global implications	7	12	33	32	14
Sustained involvement	13	17	26	20	16
Undertake assessment	5	9	23	21	35

n=161

Table 18

Classroom teachers' responses to teaching, teaching and curriculum

	frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Engage in independent learning	11	18	38	18	9
Provide motivation .	20	34	31	10	0
Develop deep understandings	17	26	40	12	1
Awareness of the global implications	7	9	26	38	13
Sustained involvement	11	16	23	16	5
Undertake assessment	2	7	25	20	40

n=122

The findings from this study suggest the majority of participants engage their students in independent learning, provide motivation and develop deep understanding about the topic or topics being studied sometimes if not often or frequently. The area that ICT seems to be least used is that of formative and summative assessment.

4.8.10 Achieving Outcomes

To gain an understanding of how respondents monitored student performance they were asked to indicate how often they incorporated student use of ICT to achieve the following outcomes:

- Demonstrate what they have learned;
- Remediate skills not learned well;
- Actively construct knowledge that integrates;
- Communicate with others using electronic modes email /discussion forums;
- Develop an understanding of the world by finding out about ideas and information;
- Analyse information;
- Present information to an audience;
- Acquire knowledge, skills and attitudes to deal with ongoing technical change;
- Learn to work collaboratively

Tables 19 and 20 which follow, presents the responses to the statements above regarding the achievement of outcomes.

For the statements about achieving outcomes Cronbach's Alpha reliability is 0.95 for the whole group with an item mean of 3.03. When an analysis was carried out on only the classroom teachers' responses Cronbach's Alpha reliability was 0.94 with an item mean of 3.07. This would tend to indicate that overall the item means for the classroom teachers' response were similar to the whole sample.

Table 19

Total Sample Achieving Outcomes

	Frequently %	often %	sometimes %	seldom %	never %
Demonstrates learning	17	29	31	6	5
Remediate skills	8	21	43	14	4
Construct knowledge	11	27	31	8	8
Communicate with others	6	8	14	37	37
Develop an understandings	14	35	24	8	8
Analyse information	5	19	35	14	14
Present information	16	31	22	11	11
Acquire knowledge, and skills	10	26	31	10	10
Learn to work collaboratively	22	30	23	5	5

n=161

Table 20

Classroom teachers' responses to achieving outcomes

	Frequently %	often %	sometimes %	seldom %	never %
Demonstrates learning	16	28	38	8	3
Remediate skills		21	47	18	2
Construct knowledge	7	31	37	14	5
Communicate with others	7	4	16	25	42
Develop an understandings	12	35	29	11	7
Analyse information	3	18	38	19	16
Present information	16	30	28	11	10
Acquire knowledge, and skills	9	27	34	11	6
Learn to work collaboratively	21	32	27	7	6

n=122

Findings for Achieving Outcomes

In this study 77% of respondents indicated students use ICT in the classroom to demonstrate what they learned either frequently (17%), often (29%) or sometimes (31%) with the majority indicating they sometimes do this. However, 11% seldom or never have students use ICT to demonstrate what they have learned. While 69% of participants stated students actively construct knowledge that integrates curriculum areas with 19% seldom or never doing so.

For the statement ‘students develop an understanding of the world by finding out about ideas and information’ 73% of the participant’s responses ranged from frequently through to sometimes and 17% of participants stated their students seldom or never do use ICT to develop their understanding about the world around them. 67% of participants frequently/often or sometimes have students acquire knowledge, skills and attitudes to deal with ongoing technical change; however 21% seldom or never have students in their classroom do this. While 65% of participants stated their students learn to work collaboratively using ICT while 12% of participants stated their students seldom or never do so.

However, 60% of respondents seldom or never have students communicate with others using electronic modes compared to 28% who do. From the data gathered 72% of the respondents have students in their classroom using computers for remedial skills and 73% finding information at least sometimes if not often.

It can be noted that a large percentage of participants of this study indicated they mainly have students use ICT to demonstrate what they have learned, finding information, remediation learning and or to collaborate using the technology. Whereas actively constructing knowledge and presentation of material did not rate as high this study suggests teachers still have students using technology for low level tasks rather than those tasks requiring high order thinking. These results are similar to studies conducted by Newhouse, (2010)

4.8.11 Assessing Student Outcomes using ICT

Student underachievement in middle and upper primary school is a concern for educators. Incorporating technology in assessment that is aligned to teaching and learning has the potential to engage students in higher cognitive processes which can lead to increased student achievement (Lincoln, 2008).

Respondents were asked to estimate how often they used the listed ICT activities when assessing student outcomes.

- Student assignments that incorporate a learning experience involving the use of an ICT application;
- Digital artefacts, from student assessments, as evidence towards student achievement;
- ICT programs, material and applications that enable assessments to be customised towards specific learning needs;
- SIS Curriculum Manager to monitor, evaluate and report on student achievement;
- Other ICT applications to monitor, evaluate and report on student achievement.

Table 21 and Table 22 look at the responses given for the above statements on assessing students outcomes using ICT.

For the statements about assessing student outcomes using ICT Cronbach's Alpha reliability is 0.87 for the whole group with an item mean of 3.12. When an analysis was carried out on only the classroom teachers' responses Cronbach's Alpha reliability was 0.84 with an item mean of 3.13. This would tend to indicate that the overall scale mean for the classroom teachers' responses was similar to the whole sample.

Table 21

Assessing student outcomes using ICT

	frequently **%**	**often** **%**	**sometimes** **%**	**seldom** **%**	**never** **%**
Student assignments	14	24	30	12	12
Digital artefacts	9	14	37	16	16
ICT programs	10	14	33	16	16
SIS Curriculum Manager	22	31	18	9	9
Other ICT applications	12	19	28	14	14

n=161

Table 22

Classroom Teachers' response to assessing student outcomes using ICT

	frequently %	often %	sometimes %	seldom %	never %
Student assignments	11	27	34	11	11
Digital artefacts	7	18	39	10	20
ICT programs	8	16	35	19	16
SIS Curriculum Manager	21	32	21	10	9
Other ICT applications	14	16	31	18	15

n=122

Findings for Assessing student outcomes using ICT

This is the area where most participants indicated they did not use ICT on a regular basis to assess student outcomes. The majority of the respondents sometimes used ICT to assess outcomes with the exception of SIS Curriculum Manager which was used frequently/often by 53% of the participants in this survey. This means that ICT is pedagogically under-used and teachers are not taking full advantage of the technologies available to them. Teachers may be grappling with how best to integrate technology into their assessment effectively and still be accountable. It is imperative that teachers are provided with opportunities to recognise the power of ICT to enrich student learning and improve teaching and assessment processes.

4.8.12 Professional use of ICT

To validate the respondent's attitude and beliefs about ICT they were asked to estimate how often they used ICT to achieve the professional outcomes highlighted below:

- Create materials for student use;
- Assess research and best practices for teaching;
- Curriculum administration – planning, monitoring, evaluating, and reporting;
- Communicate with colleagues/other professionals;
- Communicate with parents and all students;
- Post information to a website to assist their students with homework;
- Online professional learning.

Tables 23 and 24 indicate the responses made by the participants in regard to their professional use of ICT in teaching and learning.

For the statements about professional use of ICT Cronbach's Alpha reliability is 0.91 for the whole group with a scale mean of 2.72. When an analysis was carried out on only the classroom teachers' responses Cronbach's Alpha reliability was 0.90 with a scale means of 2.80. This may indicate the item means for the classroom teachers' responses were higher compared to that of the whole sample because the classroom teachers were able to reflect more accurately how they utilise technology in their day to day teaching and learning.

Table 23

Professional use of ICT

	frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Create materials	66	13	6	2	1
Assess research and best practices	32	30	18	4	3
Curriculum administration	44	27	13	3	2
Communicate with colleagues	53	20	10	9	1
Communicate with students/parents	20	18	17	11	22
Post information to a website	11	3	15	12	46
Online professional learning	12	8	22	18	27

n=161

Table 24

Classroom teachers' response to professional use of ICT

	frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Create materials	69	13	9	2	1
Assess research and best practices	29	32	21	6	5
Curriculum administration	42	31	15	4	2
Communicate with colleagues	56	18	13	6	1
Communicate with students/parents	16	20	19	14	24
Post information to a website	10	2	11	16	53
Online professional learning	8	7	24	20	34

n=122

Finding s for Professional use of ICT

There is a large variation on how frequently ICT is used to achieve tasks by the participants. The most frequently undertaken task by the respondents is using ICT to create materials to be used by students. 85% of participants stated they created materials for student use on a regular basis. Followed by communicating with peers and colleagues were 83% of the participants in this survey indicated they did this on a regular basis. It can be noted that 84% of the participants indicated they used ICT for curriculum administration on a regular basis and 80% use ICT to access research and best practice for teaching.

Where the respondents indicated they were least likely to use ICT was in the areas of communicating with parents (38% frequently/often), posting information to the web (14% frequently/often) and undertaking online professional learning (20% frequently/often). This indicates teachers may feel inadequate using online professional learning and may prefer face to face delivery.

4.8.13 Professional Knowledge

In this section participants were asked if they understood how ICT can be used to support and enhance what students learn, how students learn, and when and where student learning takes place.

Table 25 illustrates the responses made by all the participants compared to classroom teachers' understanding of how ICT can enhance student learning.

Table 25

Professional knowledge

	Whole sample %	Classroom teacher %
Yes	79.0	83
No	7.0	9
No response	14.0	8
	n=161	n=122

Findings for Professional Knowledge

For this question 79% of the participants indicated they understood how ICT can be used to support and enhance what students learn, how they learn and when and where their learning takes place with 7% of participants indicating they did not understand how IT could be used to support and enhance what students learn. There were**,** however**,** 14% of participants who did not respond to this question. For this study this means that teachers know the pedagogical justifications for integrating technologies into their teaching and learning. This is imperative if Australia is going to have technology enriched learning environments that enables students to achieve high quality learning outcomes (DER Strategic Plan 2008).

4.8.14 Professional Practice

In this section respondents were asked to indicate to what extent they use ICT to:

- Plan learning experiences within units of work that use ICT to achieve curriculum goals and which are based on students' developmental needs, interest, prior knowledge and experiences;
- Provide opportunities for students to use ICT to enhance the learning of concepts and processes, working independently and as part of a group;
- Provide challenging tasks that integrate learning areas and involve student ICT use throughout all stages of the learning process and for a range of purposes.

Table 26 and 27 depicts the responses given by all the participants compared to the classroom teachers for the statements listed in the table above on how teachers use ICT in their professional practices or practice.

For the statements about professional practice Cronbach's Alpha reliability is 0.96 for the whole group with an item mean of 2.70. When an analysis was carried out on only the classroom teachers' responses Cronbach's Alpha reliability was o.96 with an item mean of 2.75, indicating that the item means for the classroom teachers' responses was higher compared to the whole sample.

Table 26

Professional Practice

	frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Plan learning experiences	22	30	19	8	3
Provide opportunities for students	27	30	19	3	3
Provide challenging ICT use	17	19	32	6	6

n=161

Table 27

Classroom teachers' response to professional practice

	Frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Plan learning experiences	19	32	27	10	4
Provide opportunities for students	25	32	28	4	3
Provide challenging tasks	16	20	36	15	8

n=122

Findings for Professional Practice

Overall, approximately 50% of the respondents indicated they used ICT in their classroom either frequently or often to enhance the learning experiences of the students. 52% of the respondents surveyed indicated they plan learning experiences that uses ICT to achieve their curriculum goals frequently/often, with 19% of

participants stating they do so sometimes; however, 11% seldom or never plan learning experiences that uses ICT to achieve curriculum goals. In this study 57% of participants indicated they are providing opportunities for students to use ICT to enhance learning. While 19% indicated they sometimes do with 7% stating they seldom/never provide opportunities for students to use ICT to enhance learning. Of these 36% of participants stated they provide challenging tasks frequently/often with 32% doing so sometimes. 17% indicated they seldom or never provide challenging tasks that involves students using ICT. Data from this study indicates that participants may still be reluctant to avail themselves of opportunities to transform their pedagogical practices. The demand on teachers to make ICT an integral part of their teaching and learning is high thereby placing additional pressure on teachers in an already challenging profession. The data also suggests that first and foremost teachers may need to increase their own ICT skills and change elements of their current practices to utilise technology with their students and enhance learning outcomes.

4.8.15 Professional Values

In this section respondents were asked to indicate why ICT is an important aspect of their teaching and learning.

- I set my own ICT learning goals based on regular reflection of my own professional practice and determined needs;
- I am committed to developing my skills, required to exploit the potential of ICT in education;
- I critically review and select from ICT resources and teaching and learning approaches and adapt where necessary;
- I operate safely when using ICT and teach and model this practice for students;
- I am committed to developing my skills, knowledge and abilities required to exploit the potential of ICT in education.

For the above statements about professional values, Cronbach's Alpha reliability is 0.96 for the whole group with an item mean of 2.27. When an analysis was carried out on only the classroom teachers' responses Cronbach's Alpha reliability was 0.95 with an item mean of 2.33**,** indicating that the item means for the classroom teachers' responses were higher compared to the whole sample.

Table 28 and 29 depict the responses given for the statements above on the respondent's professional values in regard to integrating ICT into teaching and learning.

Table 28

Professional Values

	Frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Set ICT learning goals	29	32	15	6	5
Committed to professional learning	36	36	9	3	2
Critically review ICT resources	28	33	16	6	3
Operate safely, legally and ethically	51	29	3	1	0

n=161

Table 29

Classroom teachers' responses for professional values

	Frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Set ICT learning goals	25	34	18	8	6
Committed to professional learning	34	39	11	4	2
Critically review ICT resources	26	34	20	7	3
Operate safely, legally and ethically	55	29	4	1	0

n=122

Findings for Professional values

Approximately 60% of the respondents to this survey indicated ICT was an important aspect of teaching and learning. With 61% of respondents to the survey

indicating they set ICT learning goals often based on regular reflection of their professional practice and determined needs.

In this study 72% of the respondents indicated they were committed to developing their ICT skills, knowledge and abilities required to exploit the potential of this technology in education frequently or often while 14% indicated they sometimes, seldom or never under take the commitment to develop their ICT skills and knowledge.

In this study, 61% of the recipients critically review and select from ICT resources teaching and learning approaches and adapt them where necessary. However, 25% indicated they sometimes, seldom or never critically review ICT Resources. It can be noted that 80% of the participants indicated when using ICT they operate safely, legally and ethically and model and teach this practice to students.

4.8.16 Professional Relationships

Participants were asked to indicate how often they sought opportunities to contribute to professional teams to share what they know and practice in regards to ICT and pedagogy.

Table 30 and 31 depicts the responses given for the above statement with regard to how often respondents are seeking out others to collaborate and share ideas about ICT integration.

Table 30

Professional Relationships

	frequently %	often %	sometimes %	seldom %	never %
seek opportunities to share with others	30	21	19	9	6

n=161

Table 31

Classroom teachers' response for professional relationships

	Frequently %	often %	sometimes %	seldom %	never %
seek opportunities to share with others	27	27	19	7	4

n=122

Findings for Professional Relationships

In this study 51% of the respondents indicated they frequently/often share their ICT and pedagogical knowledge and understandings with others, whist 19% indicated they sometimes share; however 15% stated they seldom/never share ICT ideas and pedagogy with others. This indicates that participants in this study may not feel totally comfortable or competent in their own ICT knowledge to share with colleagues.

4.9 Part B: The Leadership Perspective

Leadership is one of several elements critical in the effective integration of new technologies in education. School leaders play an increasing role in leading change, especially since the nature of the job, teaching, learning and administration, has changed. Whilst old practices can be carried out, technology has allowed new practices to develop. A major challenge for school leaders has been to provide relevant professional learning for staff in effective and appropriate use of technologies to ensure the investment in hardware and software is integral to the day to day operations of the school. What is critical to the successful implementation of technology in schools is the recognition by school leadership that teacher

competencies in computer applications develops in stages and that people reach these stages at different times, through a variety of means (Brannigan, 2010; Cusack, Gurr & Schiller, 1999; Schiller, 2002)

This section we examines the role of leadership and the implementation of ICT in primary schools. The research questions covered in this section were:

- Research Question 7 – What role does leadership play in the successful integration of ICT into the classroom?
- Research Question 4 – What support structures are required to encourage teachers to make pedagogical change for the successful implementation of ICT in the classroom?
- Research Question 5 – What school cultures are most supportive of pedagogical change for the successful implementation of ICT in the classroom?

The leadership questionnaire targeted practitioners in a leadership role. It was designed to collect information on the demographics of leaders and to seek their views on a range of matters relating to ICT integration into teaching and learning, in particular in the following areas:

- Using ICT in learning and teaching;
- Support and guidance;
- The teaching process;
- Pupils' learning experience;
- Meeting student's needs;
- Staff review and development;
- Professional knowledge and learning.

This research was distributed to all Western Australian (WA) schools either by email with a link to Survey Monkey or paper copies sent via the postal service to randomly selected schools across WA. In this study 28 questionnaires were mailed back from

a range of schools and 70 questionnaire responses were collected via Survey Monkey giving a total of 98 responses. The responses were received from a range of locations and school classifications with the majority of responses coming from Level 5 Metropolitan schools.

4.9.1 Demographics

As mentioned in 4.6.1 schools in WA are classified in levels. Therefore, to enable the reader to gain a better understanding of the leadership of WA schools is explained below.

In Level 6 schools there is characteristically a Principal and three Associate/Deputy Principals who may or may not have a teaching component. Level 5 schools have 1 Principal and 2 Associate/Deputy Principals. The Associate Principals may or may not have a teaching component depending on the local arrangement of the school. Level 4 schools have 1 Principal and 1 Associate/Deputy, usually with a teaching component, and in a Level 3 school there is a principal who typically has a teaching component.

In this study 54% of the participating school leaders (Principals 38% and Associate Principals 16%) did not have a teaching role within their school and 60% of these participants were from Level 5 metropolitan schools. In this research 64% of the participants were non- teaching female leaders.

4.9.2 Using ICT in Learning and Teaching

ICT has the potential to transform the learning environment for students and re-engage teachers. The challenge for schools is to harness this potential by establishing a school culture that is supportive and encourages staff to be actively involved in the decision making process. There needs to be a school culture that enables staff to be actively creating and articulating a shared vision of ICT as an integral part of the teaching and learning process. Moreover, a culture that

establishes and enables innovation as well as a shared sense of responsibility and ownership for technology integration.

In this section respondents were asked to indicate, in their opinion, how important it is for the school to:

- Have a clear vision of its ICT integration strategies, and this vision must be shared by all members of the school community;
- Have an ICT plan that considers issues of the staff and student development, curriculum and assessment;
- Provide effective opportunities for all students to acquire an appropriate range of ICT skills; provide curriculum programs that ensure progressive and coherent development of ICT skills;
- Audit the impacts made by specific curriculum areas to the overall development of the student**s'** ICT skills, including regular opportunities to practise them.

For the five elements in using ICT in learning and teaching Cronbach's Alpha coefficient reliability was 0.91 which is considered a high coefficient of reliability and the item mean for each item within the scale was 1.54. This suggests that the reliability between items is high. A statistical analysis confirms this as both the frequency and Cronbach's Alpha coefficient reliability show high levels of agreement between participant responses and the items.

Table 32

Sample characteristics

Location	**%**
Metropolitan	55
Large country town	18
Rural	24
Remote	3
Classification	
Level 6	6
Level 5	49
Level 4	32
Level 3	13
Role	
Principal	54
Associate Principal	37
Level 3 Teacher	6
ICT co-ordinator	3
Gender	
Male	46
Female	54
Teaching component	
Yes	44
No	56

n=98

Table 33 indicates the responses made in regard to the importance of the statements in schools.

Table 33

Importance

	very important %	important %	neutral %	Slightly important %	not important %
Have a clear vision of ICT	59	37	2	1	1
Have an ICT plan	59	33	4	1	1
Provide opportunities	67	27	3	0	0
Have a progressive curriculum	48	45	4	0	0
Audit the impacts of ICT	38	42	17	0	1

n=98

Findings for Using ICT in Teaching and Learning

The overall response to the statements about how important it is for your school to have a clear vision, an ICT plan, provide effective opportunities for all, curriculum that develops ICT skills and a school that audits its impact on student learning was very positive. 54% of participants indicated it is very important and 35% stated it is important to have a clear vision for ICT integration that is agree to by all stakeholders with negligible response.

In this study 87% of the participants indicated they felt it was either very important or important to have an ICT plan that considers issues of students and staff development. Moreover, 76% of participants responded that it is very important or important to audit the impacts made by specific curriculum areas to the overall development of the student's ICT skills, including regular opportunities to practise. However**,** 16% were neutral in this area.

4.9.3 Support and Guidance

Successful and effective integration of ICT across the curriculum requires changes in school organisation and pedagogy. Attempts to fit ICT into traditional classroom practice usually results in frustration and in-effective use of a valuable resource.

In this section respondents were asked to state in their opinion how important is it that:

- School leaders lead the way by improving their own ICT competency through the attendance of staff development with classroom teachers, using ICT in their daily administration and communication tasks;
- School policies encourage and support the uptake of ICT by teachers by allowing teachers time to experiment with new teaching methods using ICT;
- School leaders employee strategies to provide their teachers with the platform and support to integrate ICT into the school curriculum;
- The appointment of an ICT coordinator to provide the administrative and pedagogical support for teachers;
- Programmes have clear frameworks for the systematic teaching of specific relevant ICT skills;
- All students have regular opportunities to practise and use specific ICT skills relevant to their learning;
- ICT skills link to and draw from a range of curriculum areas;
- Good advice is provided to staff on developing students' ICT skills;
- Programs take account of student's prior skill levels and encourage continuity and progression across the primary school.

For the eight elements in support and guidance Cronbach's Alpha coefficient reliability was 0.89 which is considered a high coefficient of reliability and the item mean for each item within the scale was 1.54. This means that the responses for this item are within the expected range. A statistical analysis confirms this as both the frequency and Cronbach's Alpha coefficient reliability shows high levels of agreement between participant responses and the items. Table 34 illustrates the responses made by the respondents to the above statements.

Table 34

Support and Guidance

	very important %	important %	neutral %	slightly important %	not important %
Leadership	60	34	2	0	1
Policies	55	37	2	3	0
Support	61	34	1	1	0
ICT coordinator	53	29	11	2	1
Frameworks	41	56	14	4	2
Opportunities to practice	60	34	0	1	0
Curriculum links	60	29	4	1	0
Prior skills	57	34	4	1	0

n=98

Findings for Support and Guidance

Overall the respondents to this survey indicated they felt that all the aspects were either very important or important, to supporting and guiding ICT integration in their schools. With 94% of participants indicating they felt the school leader should improve their own ICT skills by attending Professional Learning opportunities with their staff and to use IT regularly in their administrative and communication tasks.

In this study, 92% of participants indicated school policies which encourage and support the uptake of ICT by teachers through the allocation of time to experiment with new teaching pedagogies was very important (55%) or important (37%).

For the statement about the appointment of an ICT coordinator to provide the administrative and pedagogical support to teachers, 82% of participants positively indicated this was very important (53%) or important (29%); however there were 11% of respondents who were neutral on this position.

4.10 The Teaching Process

Research indicates that in schools where administration and curriculum leaders value, model and support ICT integration students are presented with greater opportunities for learning with ICT (Lee & Gaffney, 2009; Peterson, 1999).

In this section respondents were asked to indicate using a scale from very important, through to not important in their view:

In order to optimise the potential of ICT, there should be a shift in pedagogy**,** design of the curriculum and assessment;

- ICT should be integrated into the school to meet the curricular goals;
- When ICT is perceived by teachers as tools to meet the curriculum goals, they are more likely to integrate ICT into their lessons;
- When ICT is employed in the learning environment, there will be a shift in teaching and learning strategies;
- Teachers use appropriate blends of approaches, which include the use of ICT, where appropriate;
- ICT Resources are well organised so that both teachers and students have access;
- Teachers are aware and make use of appropriate safe user protocols, including protocols for access to the Internet;
- Teachers can access immediate and effective technical support so that the flow of learning and teaching can be maintained when problems with ICT occur;
- Teachers engage students in challenging and stimulating discussion about the use of ICT to ensure that their skills are developing to their maximum potential.

For the nine elements in the teaching process Cronbach's Alpha coefficient reliability was 0.87 which is considered a high coefficient of reliability and the item mean for

each item within the scale was 1.53. A statistical analysis confirms this as both the frequency and Cronbach's Alpha coefficient reliability show high levels of agreement between participant responses and the items.

Table 35 depicts the responses made by respondent in regard to the views on the above statements regarding the teaching process.

Table 35

The teaching process

	very important %	**important %**	**neutral %**	**slightly important %**	**not important %**
Pedagogy & assessment	39	33	17	6	2
ICT integration	44	48	3	0	1
ICT as a tool	63	29	3	1	0
Teaching and learning	45	36	11	3	1
Eclectic approach	59	35	2	0	1
Access to computers	68	25	2	1	0
Safety protocols	69	24	1	2	0
Technical support	75	20	2	0	0
Engage students	47	38	5	4	1

n= 95

Findings for the Teaching Process

Overall the respondents of this survey had a very positive view of the importance of all these aspects on the teaching process. 75% of the respondents indicated immediate and effective access to technical support so the flow of learning and teaching can be maintained when problems with ICT occur was the most critical factor in integrating ICT into the teaching process.

Coupled with this 68% indicated it was very important and 25% stated it was important to have ICT resources well organised to ensure teachers and students have access.

In this study, 39% of the respondents indicated 'to optimise the potential of ICT, there should be a shift in pedagogy design in curriculum and assessment', was very

important with a further 33% stating it was important. However, 45% indicated it was very important and 36% indicated it was important that there is a shift in teaching and learning strategies when using ICT as a teaching tool.

4.11 Students' Learning Experience

Finding ways to engage students in learning is often difficult especially if motivation is lacking. This section looks at the beliefs of the leadership in regards to ICT in teaching and learning. The respondents were asked to indicate the extent to which each of the following statements relates to their beliefs about ICT in schools:

- The use of ICT stimulates students and increases their motivation in the curriculum area;
- The use of ICT increases the pace of learning for individuals and groups of students;
- Students are responsive and self-confident when offered opportunities to use ICT independently, or in groups;
- Students are good at helping each other to develop skills in ICT;
- ICT use is effective in making students independent and collaborative learners.

For the five elements in students' learning experiences Cronbach's Alpha coefficient reliability was 0.82 which is considered a high coefficient of reliability and the item mean for each item within the scale was 1.78. A statistical analysis confirms this as both the frequency and Cronbach's Alpha coefficient reliability shows high levels of agreement between participant responses and the items.

Table 36 depicts the responses given for the statements above with regard to students' learning experiences and the respondent's belief about ICT integration into teaching and learning.

Table 36

Students' Learning Experiences

	extremely likely %	likely %	neutral %	unlikely %	extremely unlikely %
Motivation	52	41	1	2	0
Pace.	23	46	22	3	1
Self-confident	34	47	8	5	1
Supportive	50	40	3	2	0
Independent	28	50	11	4	0

n=95

Findings for Students' Learning Experiences

Overall the responses to these statements were very positive with an average response rate of 82% of the respondents indicating it is extremely likely or likely that ICT will have an impact on students' learning experiences.

The area the respondents of this survey believed that the statement which had the least impact was with regard to the use of ICT increasing the pace of learning for individuals and groups of students. 23% indicated they believed it to be extremely likely with 46% stating it is likely whereas 22% were unsure. 52% of participants in this study indicated they felt it was extremely likely and 41% indicated it is likely that the use of ICT stimulates students and increases their motivation.

4.12 Meeting Students' Needs

Researchers (November, 2010; Martinez, 2010; Murcia & McKenzie, 2008; Clarke, 2005) conclude that when used appropriately, computers can contribute to improving learning outcomes for students. To gain a deeper understanding of how the leadership in our schools view the use of ICT in teaching and learning, the respondents were asked to give an opinion on the following statements:

- The use of ICT reduces barriers to learning for individuals and groups of students;
- The school supports students who have limited access to ICT out of school;

- The use of ICT helps individual students to build their ICT skills, including those required outside of school and work at appropriate pace and or level;
- The school uses ICT to help teachers and students to identify specific learning needs and set individual targets;
- Students have access to ICT facilities which have been adapted where necessary and matched effectively to their specific needs.

Table 37 examines the extent to which individual participants believed the ICT meets students' needs.

For the five elements in meeting students' needs Cronbach's Alpha coefficient reliability was 0.79 which is considered a slightly better than average coefficient of reliability as .70 is considered average in social science research. The item mean for each item within the scale was 2.30.

Table 37

Meeting Students' Needs

	frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Reduces barriers	22	38	34	1	0
Support students	16	38	25	13	3
Builds ICT skills	23	45	24	0	1
Identifies specific needs	14	30	38	10	2
Access resources	19	34	31	9	1

n=95

Findings for Meeting Students' Needs

The majority of responses were for the sometimes too often categories, when the respondents were asked about how they use ICT to meet student's needs. There were 12% of participants who seldom or never use ICT to support student's needs.

In this study, 60% of the respondents frequently or often use ICT to reduce barriers to learning for individual or groups of students. With 54% stating that their school supports students who have limited access out of school to ICT. Further investigation is needed to explore how this is achieved.

4.132 Staff Review and Development

The type of pedagogical approach taken by teachers to ensure new technologies become an integral part of teaching and learning is largely dependent upon the attitude of teachers and how much they are willing to integrate this technology into their teaching practices. This will depend on how comfortable the teachers are in using the technology and the support they are offered from the school community. Professional learning plays an important part in developing the person's confidence and competence in implementing ICT into teaching and learning. It needs to be targeted to match the needs of the learner, given time and provide skills and tools to create or progress towards individualised student-centred, collaborative learning and promote teacher student interactions (Ertmer, 1995; Schuck & Kearney, 2007)

In this section leaders were asked to give an opinion on:

- Leaders ensure all staff are equipped with the necessary skills in the use of ICT, thus demonstrating their commitment;
- The commitment to the use of ICT is reflected in the school's improvement plan and staff development program;
- Staff review involves active consideration of the need of each member of staff in relation to ICT;
- Staff development focuses on developing an effective blend of learning and teaching pedagogy which includes the use of ICT as appropriate;
- Teachers are aware of current resources and best practice in the use of ICT to support learning;
- The school is making best use of expertise in sharing and developing best practise.

For the five elements in staff review and development, Cronbach's Alpha coefficient reliability was 0.90 which is considered a high coefficient of reliability and the item mean for each item within the scale was 2.11.

Table 38 depicts the responses for staff review and development. A statistical analysis confirms this as both the frequency and Cronbach's Alpha coefficient reliability shows high levels of agreement between participant responses and the items.

Table 38

Staff Review and Development

	frequently %	**often %**	**sometimes %**	**seldom %**	**never %**
Staff equipped	27	37	24	3	0
School plan	35	34	20	2	1
Staff review	20	39	26	6	0
PL - blend	26	35	25	5	0
Best practice	20	34	30	6	1
Expertise	26	37	22	5	1

n=95

Findings for Staff Review and Development

The results for this study show that 64% of the respondents indicated in their opinion leaders of their school ensure staff are frequently or often well equipped with the necessary skills in the use of ICT with 24% stating that leaders sometimes ensured staff were well equipped. 35% frequently and 34% often have ICT reflected in the school's plan for improvement and 20% indicated they sometimes do.

In the area of considering the needs of staff members through the staff review process, 20% stated they frequently do whilst 39% stated often and 25% sometimes with minimal response (6%) who seldom or never consider the needs of staff. Successful and effective integration of ICT into teaching and learning research

indicates that professional learning requires a blend of technology and pedagogy. However, responses to this survey indicated 26% frequently, 35% often and 25% sometime blend the two in professional learning opportunities for staff.

4.14 Professional Knowledge

The respondents were asked to indicate that they understand ICT can be used to:

- Benefit teaching and learning and is most effective when used in the context of learning and not as an end in itself;
- Support and enhance what students learn, how they learn, and when and where their learning takes place;
- Transform what students learn, how they learn and when and where their learning takes place.

Table 39 presents the responses to professional knowledge and the degree in which participants know how ICT can be used to address the three elements noted above.

For the three elements in professional knowledge, Cronbach's Alpha coefficient reliability was 0.58 which is considered a low coefficient of reliability as a coefficient reliability of 0.70 is considered average in social science research. The item mean for each item within the scale was 1.30. This means that the responses made by participants in this study or in future studies may not be predictable.

Table 39

Professional Knowledge

	strongly agree %	**agree %**	**neutral %**	**disagree %**	**strongly disagree %**
Benefit teaching and learning	86	13	0	1	0
Support and enhance learning	76	23	1	0	0
Transform student learning	60	32	3	1	1

n=98

Findings for Professional Knowledge

Overall the responses were very positive with the majority of respondents either strongly agreeing or agreeing with the statement ICT can be used to benefit teaching and learning and is most effective when used in the context of learning and not as an end in itself. With 86% of participants indicating that they strongly agree, 13% agree and 1% of participants indicating disagreement. In this study, 76% of participants strongly agree and 23% agree that ICT can be used to support and enhance what students learn and 60% strongly agree and 32% agree that ICT can transform student learning.

It is evident from these results that respondents understand how ICT can support and enhance teaching and learning to improve student outcomes. However, when one examines the data for meeting student needs, there is a discrepancy between the understanding and the reality of what is happening.

4.15 Professional Learning

In addition to learning about new technologies and planning for and supporting its use in teaching and learning, there is a need for teachers to acquire new knowledge and skills to enable the teacher to move from the 'sage on the stage' to a guide on the side'. This requires substantial professional learning and more teacher networking and collaborative practices. Professional learning is necessary to ensure teachers have the operational knowledge required to support the implementation of innovative pedagogies (Cox et al., 2004).

This section looks at the opinions of school leaders in regards to professional learning. They were asked to state their opinion ranging from strongly agree to strongly disagree on the following:

- ICT professional development program should focus on both pedagogical and technological aspects of ICT integration;

- Just in time learning should be an integral part of the professional development of the teachers;
- Continued professional development of the teacher should be an entitlement for them;
- The professional development and learning program of the teacher should be planned based on the vision of the ICT integration;
- There should be a system of recognition for innovative and effective use of ICT integration in schools.

Table 40 depicts the responses given for professional learning. For the five elements in professional learning Cronbach's Alpha coefficient reliability was 0.53 which is considered a low coefficient of reliability as a coefficient reliability of 0.70 is considered average in social science research. The item mean for each item within the scale was 1.33. This means that the responses given by the participants were mixed and not as expected.

Table 40

Professional Learning

	Yes %	**No %**	**neutral %**
Focused PL on pedagogy and technology	94	2	3
Just in time learning	70	5	25
PL should be an entitlement	87	2	10
PL should be planned around ICT vision	83	1	14
There should be a system of recognition	69	8	21

n= 98

Findings for Professional Learning

For this section the overall responses are very positive with 94% stating that in their opinion professional learning should focus on both pedagogical and technical aspects of ICT integration, with 70% believing that just in time learning should be an integral part of professional learning. 25%, however, were unsure and 5% disagreed.

For this study 87% indicated they believed that continual professional learning is a teacher's entitlement with 10% unsure and 1% in disagreement.

For the statement ICT professional learning should be planned, 83% of participants indicated they believed it should be planned with 14% unsure and 1% indicating it should not be planned.

For the statement; there should be a recognition system for innovation and effective use of ICT integration 67% agreed with this, 21% were unsure and 8% believe there should not be a recognition system.

4.16 Part C: At the Grassroots Level

The following section gives some background into how this study became a focus for the researcher. This section details how the Singaporean experience has evolved and details some factors that have provided a starting point for this study. For example the use of interactive whiteboard, and touch screens. In having the Singaporean experience enabled the researcher to see what was possible and served as a valuable touch stone for this project

During 2009 the researcher, attended a conference in Singapore on 'Charting the new education landscape'. It was while attending this conference an opportunity arose to visit one of the primary schools which, through the support and vision of the government (Singapore's ICT master-plan 1997 – 2008) and school leadership, demonstrated what she believed to be a good example of ICT integration in the curriculum. The Associate Principal observed classes using an array of technology throughout their lessons such as small hand held electronic devices, computers (PC and Notebooks) and interactive whiteboards across various curriculum areas. In one class 10 year old students were using small hand held video/sound devices to assist them with their science topic. Each student had a device which showed a video clip

of the lifecycle of a butterfly. Students viewed and listened to the clip to research information needed to complete a worksheet. This was a good example of technology being used to deliver an individualised lesson which enabled students to complete an activity at their own pace.

In another class 11 and 12 year old students were working collaboratively in pairs with tablet notebooks reviewing and editing a piece of text. The school had a wide range of technologies for the students use ranging from small hand held devices for individual instruction to interactive whiteboards and a ceiling mounted data projector for whole class or small group work.

What impressed the researcher the most was the government's commitment to providing funding to support the schools integration of ICT and the expectation that teachers will use it. The school and the government insist on staff professional learning and is a requirement for employment within the education system.

Previously in 2005, as part of a research project**,** the researcher observed how fourteen New Zealand primary schools were tackling the issue of ICT integration into teaching and learning. Whilst there she observed students using PDA's (*Personal Digital Assistants*), in the classroom along with their PC to complete an activity that incorporated, research, and creating and reporting on a project.

In both of these situations, Singapore and New Zealand, the students were fully engaged and motivated in the task. The factor both of these places had in common was the vision and support of their leadership. It is difficult to implement ICT as observed in these countries without the vision and support of the school leadership and without the purchasing power required for necessary equipment.

One thing lacking in Australia, and especially in Western Australia, is the follow through of initiatives. DoE has started many programs but, on a whole, they were not completed. For example, School A was part of a three year LwICT program which ceased after the first year because of a change in direction and emphasis by the Department. This meant the professional learning that was to accompany the project was not going to be completed. Consequently it became the responsibility of the LwICT coordinator to continue implementing the program. Without a strong leadership with a vision for the potential of technology to enhance the learning outcomes for students, the project was doomed to fail.

4.16.1 School Context

School A is a level 5 middle-class school. It is in the northern metropolitan suburbs located in the City of Joondalup, twenty kilometres north of Perth in the state of Western Australia. It currently has an enrolment of 476 students from Kindergarten to Year 7. The school opened in 1983 and is a cluster shaped, fully air-conditioned brick building. The grounds have been pleasantly landscaped, with grassed areas, gardens and shady trees. There are three clusters which house six classrooms surrounding a wet area.

Technology is progressive with 97 networked computers available for student use, located in classrooms, mini labs and the Library/Resource Centre. All computers are fully networked with high speed broadband internet connection. Across the school there are seven *Interactive Whiteboards* (IWB) fully installed with data projector and speakers, one mobile IWB with data projector and each classroom has a digital camera.

Over the years the school has been involved in many different **'**learning with technology initiatives', starting back in 1997 with 'The Internet in the Curriculum' program to today's current project, LwICT (Learning with Information, Communication Technology) project.

In 2009 the school became part of the SOCs (Schools Online Curriculum) project which is funded by the Department of Education. This project enables five teachers to be trained in various modules over two years to support and assist other staff in becoming part of the OTLS (Online Teaching and Learning Systems). Another group of teachers has become involved in the 'Partnerships in Action' project between Edith Cowan University, school A and one other northern suburbs primary school This project aims to develop a collaborative, authentic learning model to enhance and sustain professional learning outcomes for teachers and K-7 pre-service teachers in partnership with students at local primary schools.

As a school the technology implementation has been hindered by the lack of visionary leadership. Even though the school has participated in the various initiatives and programs offered by the Department, the overall implementation has not been fully supported by the leadership. Most of the emphasis of the government has been to put 'boxes' in schools but have failed to support the integration of these **'**boxes**'** by providing professional learning for staff.

At School A the staff had made some in-roads into infusing a variety of technologies into the classroom. The school is very well equipped with PCs for student and teacher use, and the teachers have access to the 'Notebook for teachers program' offered by the Department. In the last couple of years there has been a push to get interactive whiteboards (IWB) into the classrooms. This started with the purchase of one mobile interactive smart board which was funded from the 'Improving our schools' Federal Government grant. The smart board was then housed in the library for the staff to use.

There was some professional learning offered with the interactive whiteboard but very few teachers demonstrated an interest in this new equipment as evidenced by the professional development log kept by the ICT coordinator. According to the Library Officer, the board sat unutilised in the library for a couple of terms Then the former LwICT coordinator moved the interactive whiteboard it into her classroom

and organised the curriculum support person from district officer to come and demonstrate how to integrate the board into her teaching and learning. Once the board was being used with good effect the LOTE and music teachers began to show an interest in how the board could be used to support their teaching and learning programs. After trailing the board in their classes the two teachers approached the P & C for funding to purchase more boards. This was granted and School A obtained three more boards which were placed in the Music, LOTE and Year 7 classroom. With the mobile board in the library still available for staff to use, other teachers began to express a desire to trial it in their room.

The school approached ECU (Edith Cowan University) about forming a partnership to access professional learning opportunities for staff. As part of this, School A became involved in the 'Partnership in Action' project. To support the staff who nominated to be part of this initiative the former LwICT coordinator successfully obtained three more boards through the generosity of the P& C. As a consequence the school is now beginning to move forward in that some of the teachers are endeavouring to integrate the use of technology into their teaching and learning. Nevertheless, the staff was hindered by a lack vision and leadership in the area of ICT. The passion and/or vision of a few is not enough if the leadership within the school cannot see the value of ICT or be open to at least investigate change and explore possibilities.

4.16.2 School A- the Initial Survey

Prior to working with the teachers their perceptions of ICT in education were explored through the use of the Department of Education (DoE) Self Evaluation Guide (SEG). The SEG collected data in six main areas. The first focused on facilitating student learning in relation to connections to the Curriculum Framework, student application of ICT, attitude, teacher as orchestrator, repertoire of teaching strategies and ICT access and use. The second area considered assessing student learning outcomes and the third engaging in professional learning. Area four looked at participating in curriculum policy and program initiatives while area five focused

on forming partnerships within the school community. The sixth and final area of the SEG focused on teacher's ICT skills and knowledge looking at peripherals, application and online services.

A list of the dimensions is given in Table 41 and it should be noted that Dimensions of Practice 1 and 6 have sub sections. Within each phase are specific descriptions related to the six dimensions.

Table 41

Description of the Dimensions of practice

Dimensions of Practice
1 Facilitating Student Learning
1.1 Connection to Curriculum Framework
1.2 Student Application of ICT
1.3 Attitude
1.4 Teacher as Orchestrator
1.5 Repertoire of Teaching Strategies
2. Assessing Student Learning Outcomes
3. Engaging in Professional Learning
4. Participating in Curriculum Policy and Program initiatives
5. Forming Partnerships within the School Community
6. Teachers' ICT Skills and Knowledge
6.1 Peripherals
6.2 Application
6.3 Online services

Note: From Department of Education and Training (2003)

Summary of findings from the SEG

The *Self Evaluation Guide* (SEG) was developed, to give teachers a tool that could be used to gain a sense of the individual's current skill and understanding of teaching and learning with ICT. It is a framework that takes into consideration the level of skills developed, and in what areas. In the guide there are 5 phases for teachers to make a judgement about their current skills and understanding of teaching and learning with ICT. This is important in the context of this study because it enabled the school and the researcher to evaluate how far the staff had progressed under the two years of the LwICT project and where school needed to go next to sustain the momentum.

The SEG is divided into phases. To enable the reader to understand the data, charts have been provided along with an explanation of the phases.

Facilitating student learning

For the section of **Facilitating student learning**, represented in figure 5, teachers needed to indicate where they sat on the continuum for these areas:

- Connection to Curriculum Framework
- Student application of ICT
- Attitude
- Teacher as orchestrator
- Repertoire of teaching strategies
- ICT access and use

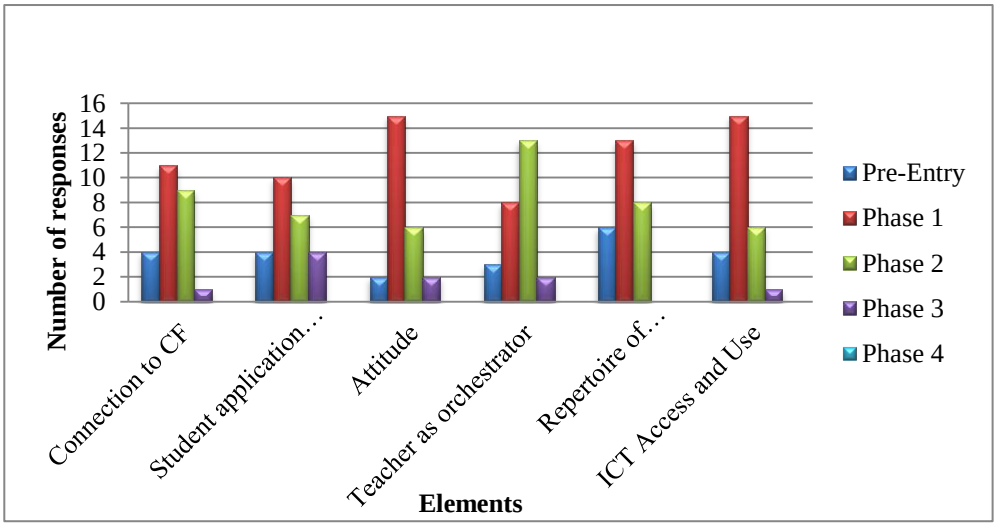

Figure 8: Facilitating Student Learning (2007)

The SPSS reliability procedure suggests that all items contribute strongly to the composite score with an alpha reliability coefficient of 0.91 and the item mean score of 2.28.

The Dimensions of Practice with its corresponding Phases of Development and description of practice is detailed in Table 42.

Table 42

Dimensions of practice - connection to Curriculum Framework

Phases of Development	Dimensions of Practice
	1.1 Connection to CF
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Application of Curriculum Framework does not involve connection to ICT
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Applies ICT to specific aspects of the Curriculum Framework
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	Applies ICT outcomes across learning areas in the Curriculum Framework
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Applies ICT to enrich learning activities that are authentic, multidisciplinary and demonstrates knowledge and relevance to the Curriculum Framework outcomes
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Creates innovative online learning programs that support achievement of outcomes across all learning areas.

Note: From the Self –evaluation guide WA Department of Education, (2003

For **connection to the *Curriculum Framework*** (CF) - four teachers (16%) indicated they were at the pre-entry stage. Eleven teachers (44%) indicated they were at phase one; with nine teachers (36%) indicating they were at phase 2 and one teacher (4%) indicated being at phase 3. These results present a positive disposition to engage teachers in the LwICT project because the majority of teachers indicated they were already applying some ICT to aspects of the Curriculum to achieve learning outcomes. This enables the school to put strategies in place to encourage those teachers who are not already exploring the use of ICT in areas of the curriculum to

have a go and to develop the skills and knowledge of those teachers who are already champion to the cause.

Table 43

Dimensions of practice - Student application

Phases of Development	Dimensions of Practice
	1.2 Student application of ICT
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Others are responsible for student use of ICT to support learning
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Focus is on students' use of ICT as a tool and development of ICT literacy skills Students' access to software programs is used as a reward
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	Focus is on students' use of ICT as a learning tool to support achievement of learning outcomes
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Focus is on students' independence in appropriate use of ICT to meet their learning needs to achieve outcomes' Learning with ICT is oriented towards constructing meaning and solving problems of consequence
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Focus is on students' interacting and creating online learning experiences

Note: From the Self –evaluation guide WA Department of Education, (2003).

For **student application of ICT** – four teachers (16%) indicated they were at the pre-entry stage; ten teachers (40%) indicated they were at phase 1, seven teachers (28%) indicated they were in phase 2; and four teachers (16%) indicated they were at phase 3. As a starting point these results present a positive outlook because the majority of teachers indicated they were phase at 1 or above, the focus of which being on using ICT as a learning tool. This result enables the school to put strategies in place to encourage those teachers who are not already exploring the use of ICT to support student learning.

Table 44

Dimensions of Practice – Attitude

Phases of Development	Dimensions of Practice
	1.3 Attitude
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	comfortable that existing teaching, learning and assessment practices adequately promote student learning without the use of ICT
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	willing to extend the repertoire of teaching and learning practices
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	feel in control, confident and comfortable with ICT
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	ICT thinking, usage and integration is second nature and they are capable of operating independently and interdependently in collaboration with others.
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Examines directions in online learning and provides advice to the education community

Note: From the Self –evaluation guide WA Department of Education, (2003).

For the element **attitude** - two teachers (8%) indicated they were at the pre-entry stage, fifteen teachers (60%) indicated they were at phase one, six teachers (40%) indicated they were in phase 2; and two teachers (8%) indicated they were in phase 3. These results indicate e teachers at School A are willing to extend their repertoire of pedagogical practices.

Table 45

Dimensions of Practice – Teacher as Orchestrator

Phases of Development	Dimensions of Practice
	1.4 Teacher as orchestrator
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Designs learning experiences to engage their students without the use of ICT.
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Teacher assumes primary responsibility for ICT use and teachers allow for student's collaboration and self-direction in some instances.
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	Students access ICT through teacher directed activities and using ICT students have more opportunities to adopt roles, stimulating authentic class, work collaboratively an independently and begin to rely on each other main questions arise.
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Students are self-directed and have opportunities to select and use our range of technologies for learning experiences.
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Creates scaffolding for online learning for students which reflects individual learning styles and needs

Note: From the Self –evaluation guide WA Department of Education, (2003).

For the element **teacher as orchestrator** - three teachers (12%) indicated they were in the pre-entry stage. Eight teachers (32%) indicated they were in phase 1. There were thirteen teachers (52%) who indicated they were in phase 2 and three teachers (12%) indicated they were in phase 3. It was evident from these results that teachers were in control of the ICT applications in their classrooms.

Table 46

Dimensions of Practice – Repertoire of teaching strategies

Phases of Development	Dimensions of Practice
	1.5 Repertoire of teaching strategies
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Provides learning experiences to accommodate the learning styles and needs of students without the use of ICT. May allow some students to use computers if they choose to do so, critically at home or at the library, but they and feel unwilling or uninterested in changing what seems successful
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Teacher experiments with new teaching strategies using ICT
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	ICT is applied to student focus strategies that are at are enhanced with ICT
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Use of ICT is a crucial learning tool to the achievement of learning objectives Learning activities involving ICT are highly interactive, responsive to student needs and include authentic online tasks and audiences
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Employs a range of eLearning strategies – creating open-ended inquiry based tasks using online learning content management systems

Note: From the Self –evaluation guide WA Department of Education, (2003).

In the area of **repertoire of teaching** – six teachers (24%) indicated they were in the Pre-entry stage, thirteen teachers (52%) indicated they were in phase 1 and eight teachers (32%) indicated they were in phase 2.

Table 47

Dimensions of Practice – ICT access and use

Phases of Development	Dimensions of Practice
	1.6 ICT access and use
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	ICT access and use occur outside the classroom and do not involve the class teacher
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Most ICT is in Computer Labs and not readily accessible for classroom integration. Classroom computers are located in relatively isolated parts of the classroom,
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	ICT located mostly in classrooms and controlled by teacher. Computers arranged for effective supervision by teacher and collaboration by students
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Classroom ICT access is a shared responsibility of teachers and students to have flexibility about reorganising the class environment according to need
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	ICT access is readily available throughout the classroom, school and at home

Note: From the Self –evaluation guide WA Department of Education, (2003).

In the final section on **facilitating student learning** in the area of **access and student use** – four teachers (16%) indicated they were in the pre-entry stage, fifteen teachers (60%) indicated they were in phase 1; and one teacher (4%) indicated they were in phase 3;. These results indicate that the majority of teachers were in phase 1 at the start of the LwICT project for facilitating student learning.

It is interesting to note at the beginning of the school's LwICT journey teachers indicated they were mainly in phase 1 across all elements for facilitating student learning.

Table 48

Dimensions of Practice - Assessing Student Learning

Phases of Development	Dimensions of Practice
	2. Assessing student learning
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Assessment strategies do not include the use of digital media.
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Some assessment portfolios contain digital learning experiences
Phase 2 – teachers meet the first student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	Digital assessments valued by teachers and students to demonstrate achievement
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Assessment tasks produce products of value to the student, teacher or broader audience that demonstrate evidence of using ICT. Assessments are comprehensive and utilise a diverse range of digital media.
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Students, teachers and parents use eLearning systems to monitor, evaluate and report about learning.

Note: From the Self –evaluation guide WA Department of Education, (2003).

In the section **Assessing student outcomes** it is interesting to note that teachers indicated they engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement for assessing student learning. In particular, some assessment portfolios contain digital learning experiences.

Assessing student learning outcomes

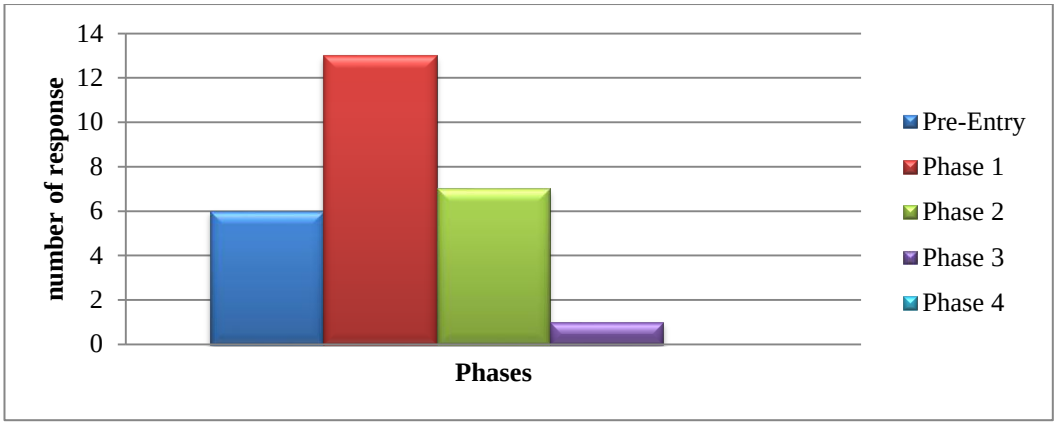

Figure 9: Assessing Student Learning Outcomes (2007)

At the start of the LwICT project six teachers (24%) indicated they were in the pre-entry stage, thirteen teachers (52%) indicated they were in phase 1, while seven teachers (28%) indicated they were in phase 2; and one teacher (4%) indicated they were in phase 3.

Professional Learning

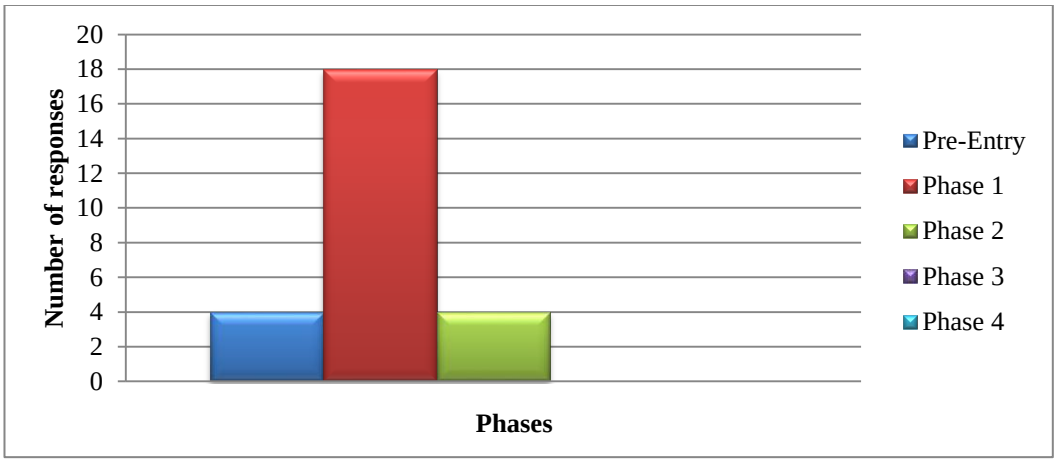

Figure 10: Engaging in Professional Learning (2007)

In the section **Engaging in Professional Learning**, four teachers (8%) indicated they were in the pre-entry stage, eighteen teachers (72%) indicated they were in phase 1 and four teachers (8%) stated they were in phase 2.

Table 49

Dimensions of Practice – Engaging in Professional Learning

Phases of Development	Dimensions of Practice
	3.Engaging in Professional Learning
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Professional learning does not involve learning about or using ICT.
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Uses ICT to support professional learning.
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	Contributes to networks to collaboratively design and evaluate integrated ICT strategies. Support colleagues in their use of ICT.
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Initiates and facilitates research and dialogue in exploring innovative applications of ICT in teaching, learning and assessment.
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Leads professional learning about eLearning in teaching, learning and assessment.

Note: From the Self –evaluation guide WA Department of Education, (2003).

It was interesting to note that for the section on engaging in professional learning the majority of the teachers indicated they were in phases 1 and used ICT to support professional learning. However, data gathered from interviews and observations suggests many teachers did not access the DoE 'Online professional learning portal' or the 'Teachers have class' professional learning opportunities.

Curriculum Policy and Programs

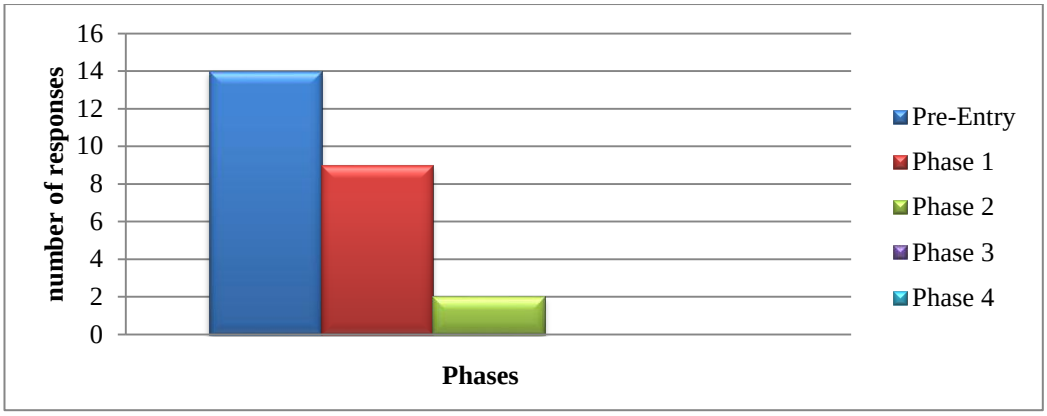

Figure 3: Participating in Curriculum Policy and Program initiatives (2007)

Table 50

Dimensions of Practice – Participating in Curriculum Policy and Program initiatives

Phases of Development	Dimensions of Practice
	4. Curriculum policy and program initiatives
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Assessment strategies do not include the use of digital media.
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Some assessment portfolios contain digital learning experiences
Phase 2 – teachers meet the first student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	Digital assessments valued by teachers and students to demonstrate achievement
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Assessment tasks produce products of value to the student, teacher or broader audience that demonstrate evidence of using ICT. Assessments are comprehensive and utilise a diverse range of digital media.
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Students, teachers and parents use eLearning systems to monitor, evaluate and report about learning.

Note: From the Self –evaluation guide WA Department of Education, (2003).

In the section **participating in curriculum policy and program initiatives**, fourteen teachers stated they were in the pre-entry stage; this stage refers to not contributing to ICT related curriculum policies or initiatives, nine teachers indicated they were in phase 1; contributes information to assist the work of school curriculum policy and program teams associated with ICT and two teachers indicated they were in phase 2; active participants in partnerships.

Partnerships in the School Community

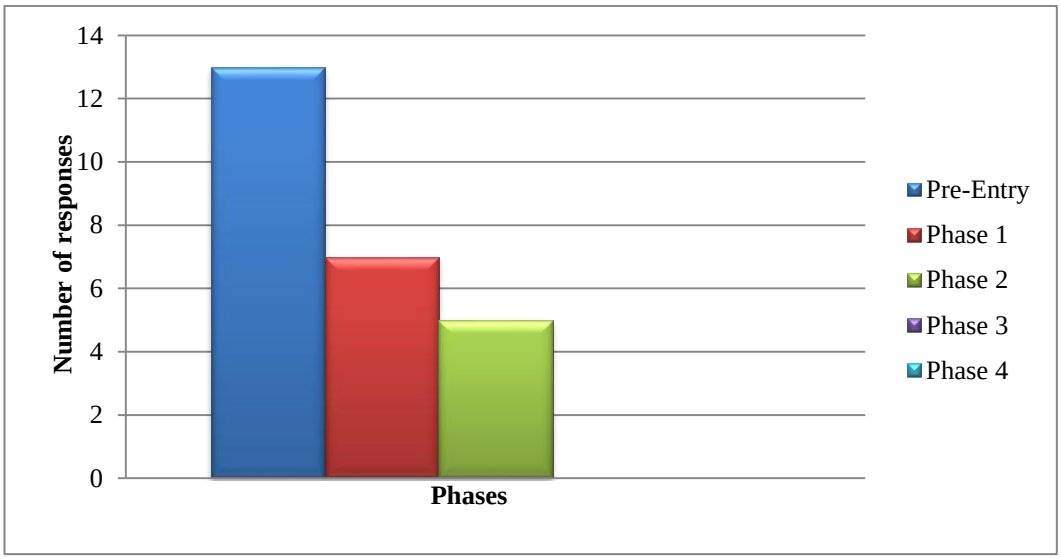

Figure 4: Forming Partnerships within the School Community (2007)

In the section **forming partnerships with the school community**, thirteen teachers (52%) indicated they were in the pre-entry stage, seven teachers indicated (28%) they were in phase 1; and five teachers (20%) indicated they were in phase 2. This result indicated teachers need to be encouraged to share and collaborate with others and to take an active interest in developing an ICT culture within the school community.

Table 51

Dimensions of Practice – Forming Partnerships within the School Community

Phases of Development	Dimensions of Practice
	5. Forming partnerships within the school community
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Does not associate with partnerships about or using ICT.
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Contributes to partnerships initiated by others.
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	Actively participates in partnerships.
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Is a leader in the development of partnerships.
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Builds sustainable online learning communities with students, parents and colleagues.

Note: From the Self –evaluation guide WA Department of Education, (2003).

Teachers' ICT skills and knowledge

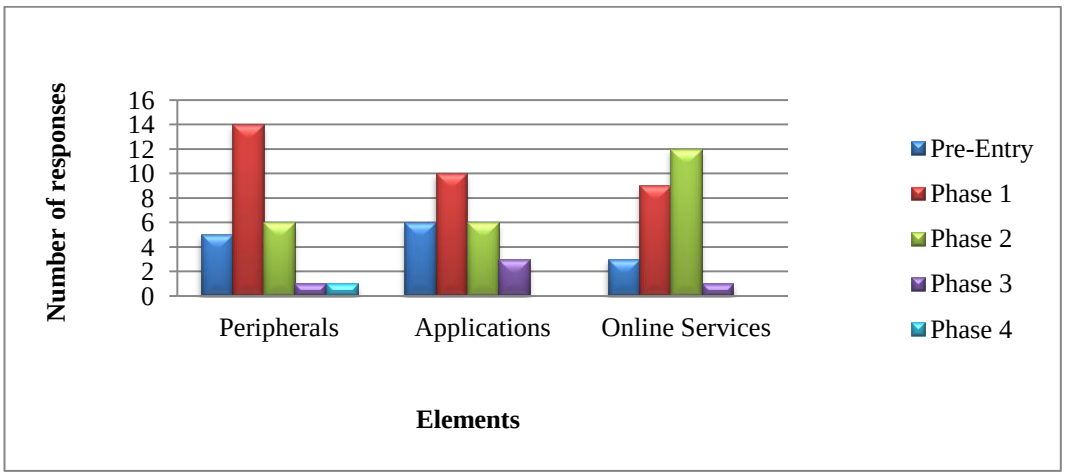

Figure 5: Teacher's ICT Skills and Knowledge (2007)

In section 6 of the SEG of teacher's skills and knowledge teachers were asked to indicate where they were in relation to:

- Peripherals
- Applications
- Online services

Table 52

Dimensions of Practice – Teachers' ICT skills and Knowledge - Peripherals

Phases of Development	Dimensions of Practice
	6.1 Peripherals
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Peripherals are not used.
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Independently operates a limited range of peripherals. Focus on technologies specific to teaching areas such as MISI keyboard, scanner or digital camera
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	Comfortable using a range of peripherals. Require support using new peripherals and solving problems.
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Able to transfer skills to new peripherals without support and use it transparent.
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Actively explore new technologies and assess their potential for enhancing learning.

Note: From the Self –evaluation guide WA Department of Education, (2003).

In the **peripherals** section five teachers (20%) indicated they were in the pre-entry stage for peripherals, fourteen teachers (56%) indicated they were in phase 1 and five teachers (20%) indicated they were in phase 2;

Table 53

Dimensions of Practice – Teachers' ICT skills and Knowledge - application

Phases of Development	Dimensions of Practice
	6.2 Application
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Minimal ICT skills and knowledge.
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Can operate the computer at the basic level – including starting and ending sessions, using basic software applications and making simple connections. Aware of application such as spread sheets, graphics and may have rudimentary skills using a single tool, but presentations are linear and one dimensional
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	regularly applies ICT to personal and professional productivity and can save all retrieve multimedia content and other files,
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Able to transfer skills from current to new tools quickly and independently and uses a range of multimedia technologies to create, edit and communicate learning programs and products.
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Proactive in investigating online services and tools assesses their potential for enhancing teaching, learning and assessment

Note: From the Self –evaluation guide WA Department of Education, (2003).

For the area of **applications,** six teachers (24%) indicated they were in the pre-entry stage, ten teachers (40%) were in phase 1; six teachers (24%) in phase 2; and three teachers (12%) indicated they were in phase 3.

Table 54

Dimensions of Practice – Teachers' ICT skills and Knowledge - online services

Phases of Development	Dimensions of Practice
	6.3 Online services
Pre-entry – teachers engage their students in purposeful and appropriate learning experiences without the use of ICT.	Do not operate on the network and do not access online services.
Phase 1 – teachers engage their students in sequences of purposeful and appropriate learning experiences and use ICT to increase student productivity and engagement.	Knows how to browse the web efficient searches and recognizes when the network is dysfunctional and reports problems to appropriate support
Phase 2 – teachers meet the diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes.	Online information resources used where appropriate, understands and it uses efficient web search methods, bookmarks and favourites and navigates networks comfortably and independently solving simple network problems.
Phase 3 – teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practices that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities.	Creates and publishes online curriculum resources. Collaborative tools of email, listservs, chat boards, videoconferencing used regularly and appropriately. Uses network resources transparently in everyday work
Phase 4 – teachers a proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities.	Online learning experiences are investigated and created.

Note: From the Self –evaluation guide WA Department of Education, (2003).

The final aspect of this section looks at the teachers' **skills and knowledge of online services.** Three teachers (12%) indicated they were in the pre-entry stage, nine teachers (36%) indicated they were in phase 1, twelve teachers (48%) indicated they were in phase 2.

At the end of 2009, after two years of intervention through the LwICT project, teachers were asked to re-evaluate their SEG and indicate where they were at. The figures below represent the updated information.

For the section of **Facilitating student learning**, teachers needed to indicate where they were on the continuum for these areas:

- Connection to Curriculum Framework
- Student application of ICT
- Attitude
- Teacher as orchestrator
- Repertoire of teaching strategies
- ICT access and use

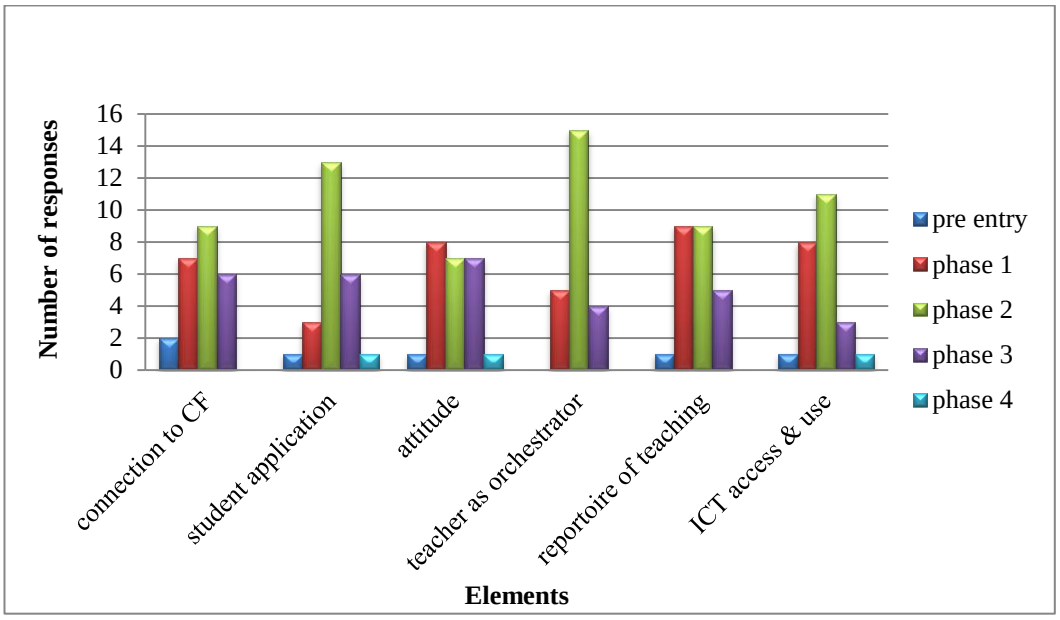

Figure 6: Facilitating Student Learning (2009)

For **connection to the CF** two teachers indicated they were at the pre-entry stage compared to four teachers in 2007, seven teachers compared to eleven teachers indicated they were at phase one, with nine teachers indicating they were at phase 2 and six teachers, compared to one previously, are now at phase 3.

For **student application of ICT** – one teacher in 2009 compared to four teachers in 2007 indicated they were at pre-entry; three teachers in 2009 compared to ten teachers in 2007 indicated they were at phase 1. Thirteen teachers in 2009 compared

to seven teachers in 2007 indicated they were in phase 2; six teachers in 2009 compared to four teachers in 2007 indicated they were at phase 3; and one teacher in 2009 now indicates they are in phase 4.

For **attitude** – one teacher in 2009 compared to two teachers in 2007 indicated they were at the pre-entry stage, eight teachers in 2009 compared to fifteen teachers in 2007 indicated they were at phase one. Seven teachers in 2009 compared to six teachers in 2007 indicated they were in phase 2; seven teachers in 2009 compared to two teachers in 2007 indicated there were in phase 3; and one teacher in 2009 indicated they are now in phase 4.

For **teacher as orchestrator** – no teachers in 2009 compared to three teachers in 2007 indicated they were in the Pre-entry stage, five teachers in 2009 compared to eight teachers in 2007 indicated they were in phase 1. Fifteen teachers in 2009 compared to thirteen teachers indicated they were in phase 2 and four teachers in 2009 compared to three teachers in 2007 indicated they were in phase 3.

In the area of **repertoire of teaching** – one teacher in 2009 compared to six teachers in 2007 indicated they were in the Pre-entry, nine teachers in 2009 compared to thirteen teachers in 2007 indicated they were in phase 1. Nine teachers in 2009 compared to eight teachers in 2007 indicated they are in phase 2 and five teachers in 2009 have now moved into phase 3.

In the final aspect of **facilitating student learning** in the area of **access and student use** – one teacher in 2009 compared to four in 2007 indicated they were in the pre-entry state, eight teachers in 2009 compared to fifteen teachers in 2007 indicated they were in phase 1 with eleven teachers in 2009 compares to six teachers in 2007 indicated they were in phase 2; three teachers in 2009 compared to one teacher in 2007 indicated they were in phase 3 and one teacher in 2009 has now move to phase 4.

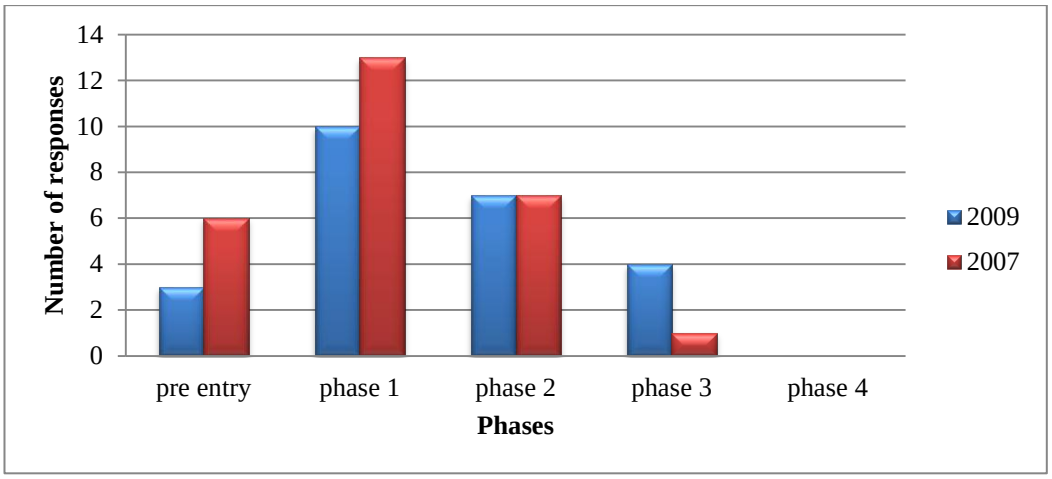

Figure 7: Assessing Student Learning Outcomes

The in section **Assessing student outcomes**, three teachers in 2009 compared to six teachers in 2007 indicated they were in the pre-entry stage, while ten teachers in 2009 compared to thirteen teachers in 2007 indicated they were in phase 1. With seven teachers in 2009 indicated they were in phases 2 and four teachers in 2009 compared to one teacher in 207indicated they were in phase 3.

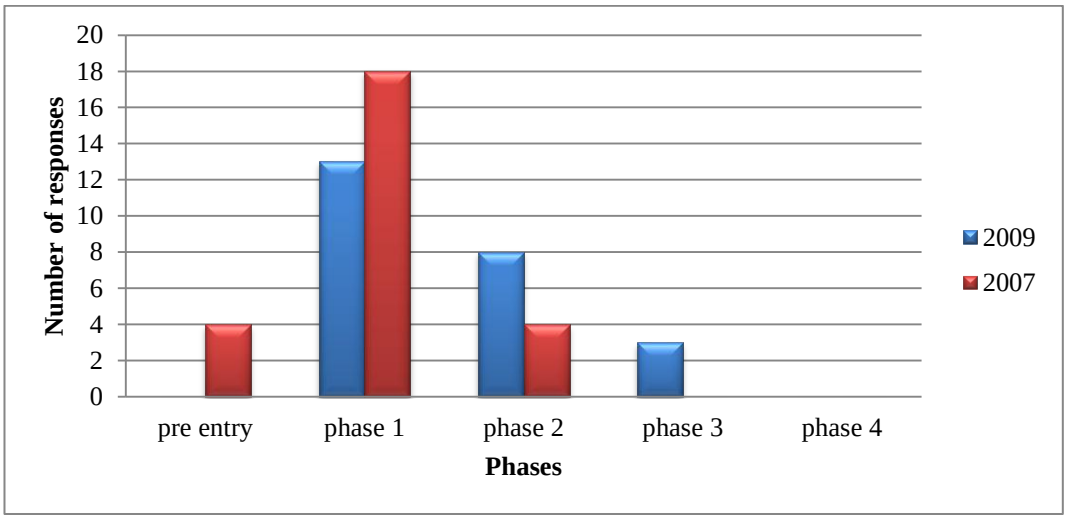

Figure 8: Engaging in Professional Learning

For **Engaging in Professional Learning**, no teachers in 2009 compared to four in 2007 indicated they were in the pre-entry stage, thirteen teachers in 2009 compared

to eighteen teachers in 2007 indicated they were in phase 1, six teachers in 2009 compared to four teachers in 2007 stated they were in phase 2 and three teachers in 2009 indicated they are now in phase 3.

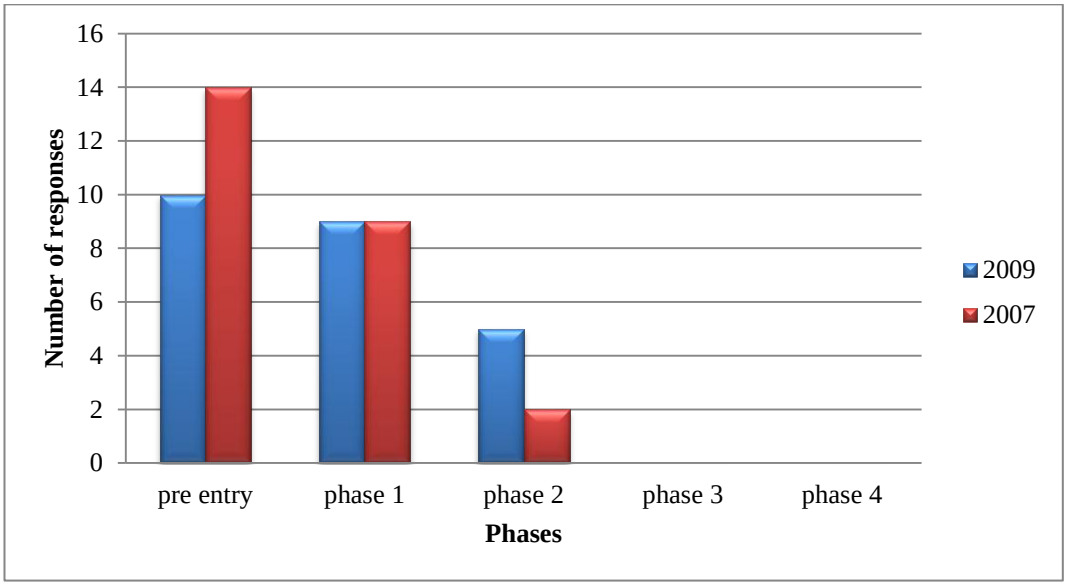

Figure 9: Participating in Curriculum Policy and Program Initiatives

In the section **participating in curriculum policy and program initiatives**, ten teachers in 2009 compared to fourteen teachers in 2007 stated they were in the pre-entry stage, nine teachers in 2009 indicated they were in phase 1 and five teachers in 2009 compared to two teachers in 2007 indicated as being in phase 2.

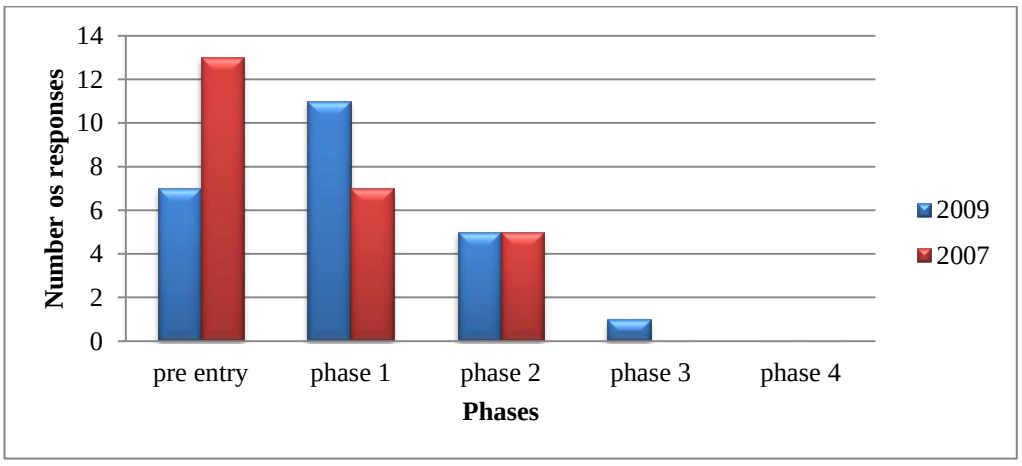

Figure 10: Forming Partnerships

For **forming partnerships with the school community**, seven teachers in 2009 compared to thirteen teachers in 2007 indicated they were in the pre-entry stage, eleven teachers in 2009 compared to seven teachers in 2007 indicated they were in phase 1, five teachers in 2009 indicated they were in phase 2; and one teacher in 2009 indicated as being in phase 3.

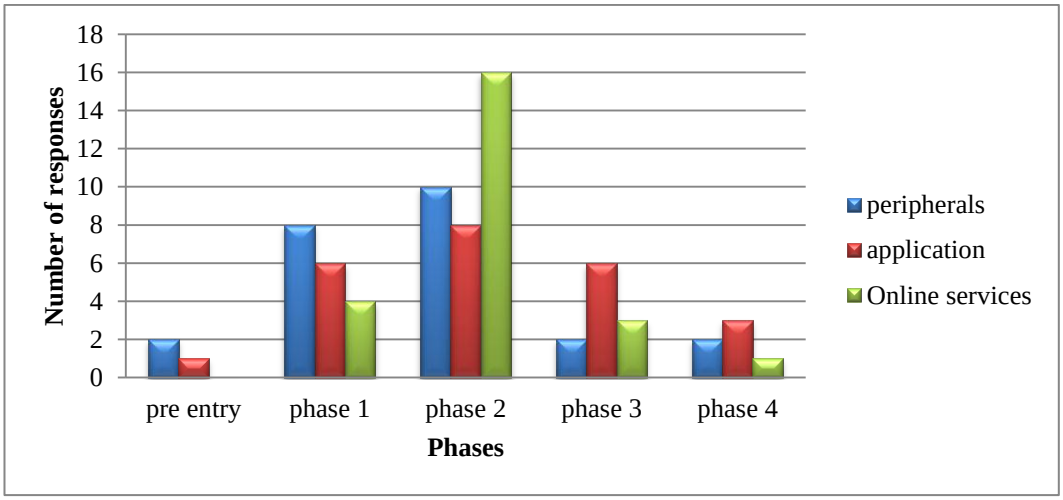

Figure 11: Teachers' ICT Skills and Knowledge

The final section of the SEG dealing with **teachers' ICT skills and knowledge** asked teachers to indicate where they were in relation to:

- Peripherals
- Applications
- Online services

In the **peripherals** section two teachers in 2009 compared to five teachers in 2007 indicated they were in the pre-entry stage for peripherals, fourteen teachers in 2009 indicated they were in phase 1; with eight teachers in 2009 compared to five teachers in 2007 indicated they were in phase 2; two teachers in 2009 compared to no teachers in 2007 indicated they were in phase 3 and two teachers in 2009 indicated they were in phase 4.

For the area of **applications**, one teacher in 2009 compared to six teachers in 2007 indicated being in the pre-entry stage, six teachers in 2009 compared to ten teachers in 2007 were in phase 1; with eight teachers in 2009 compared to six teachers in 2007 in phase 2. Six teachers in 2009 compared to three teachers in 2007 indicated they were in phase 3 and three teachers in 2009 indicated they were now in phase 4.

The final aspect of this section looks at the **teachers' skills and knowledge of online services.** No teachers in 2009 compared to three in 2007 indicated they were in the pre-entry stage; four teachers in 2009 compared to nine teachers in 2007 indicated they were in phase 1. While sixteen teachers in 2009 compared to twelve teachers in 2007 indicated they were in phase 2, three teachers in 2009 compared to one teacher in 2009 indicated they were in phase 3 and one teacher in 2009 indicated being in phase 4.

It can be noted, by investing in new technologie**s,** making ICT a priority by providing an ICT coordinator to support and help staff, along with the school's involvement in the LwICT project has contributed to the improvement in teachers' skills and knowledge regard to teaching and learning with ICT. In conclusion, what this suggests is that over the past three years during this study there is evidence of some staff movement along the SEG continua in relation to the integration of ICT into teaching and learning.

The self-evaluation guide was used to support staff and school leaders focus on improving their understandings of the use of ICT in teaching, learning and assessment.

Table 55 presents a guide on how to read the phases in each table presented in this section.

Table 55

Key for reading the phases

Pre-entry	I've not thought about it yet
Level 1	I've had a go but I'm still finding my feet
Level 2	I can make it work for me
Level 3	I use ICT in an integrated and productive way
Level 4	I know why ICT works for me and confidently share

Teachers were asked to complete the ICT Matrix in 2009 and again in 2010 to compare the progress made after a year of working with an ICT coordinator. The ICT coordinator's role was that of a support person working with the classroom teacher in a mentoring capacity.

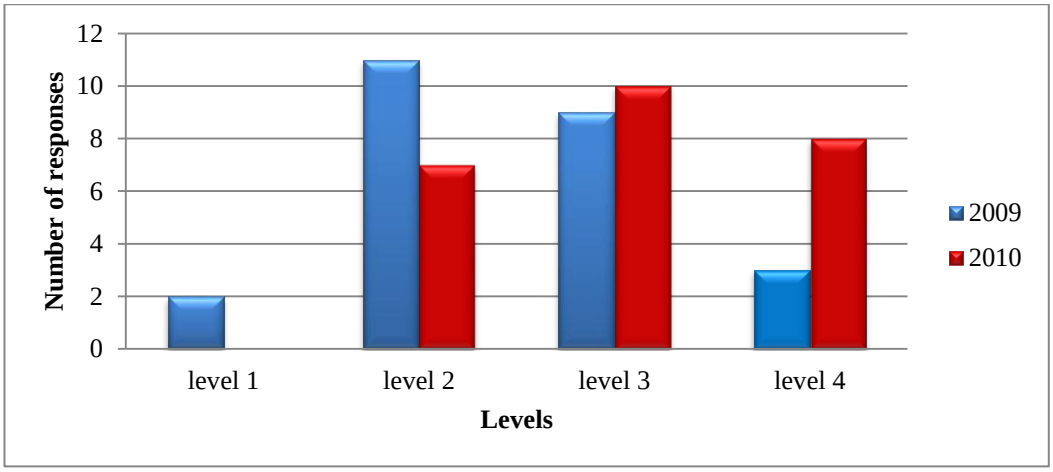

Figure 20: Using ICT Effectively in Teaching and Learning

This graph compares the results of 'Making a Difference Matrix' (see Appendix E) administered in 2009 and again in 2010. It can be noted the participants have made a shift in the use of ICT in their teaching and learning.

In 2009 there were 2 (8%) participants who indicated they were starting to think about how they could employ ICT into their teaching and learning, however, they were still finding their feet compared to no teachers indicating being in level 1 in

2010. In 2009 there were eleven teachers (44%) who indicated being in level 2, however, in 2010 this was reduced to seven teachers (28%) indicating that four teachers (16%) had move into the next level. In 2010, level 3 increased by one teacher indicating there are now ten teachers (40%) in this level and level 4 increased by five teachers giving a total of eight teachers (32%) at this level. After the implementation of the LwICT program and the support of the ICT coordinator, the results indicate most of the participants made some gains towards using ICT effectively in their teaching and learning. The matrix ranged from "I do not have any idea how to use the ICT available" through to **"**I plan for open-ended use of ICT and are happy to learn from students and colleagues".

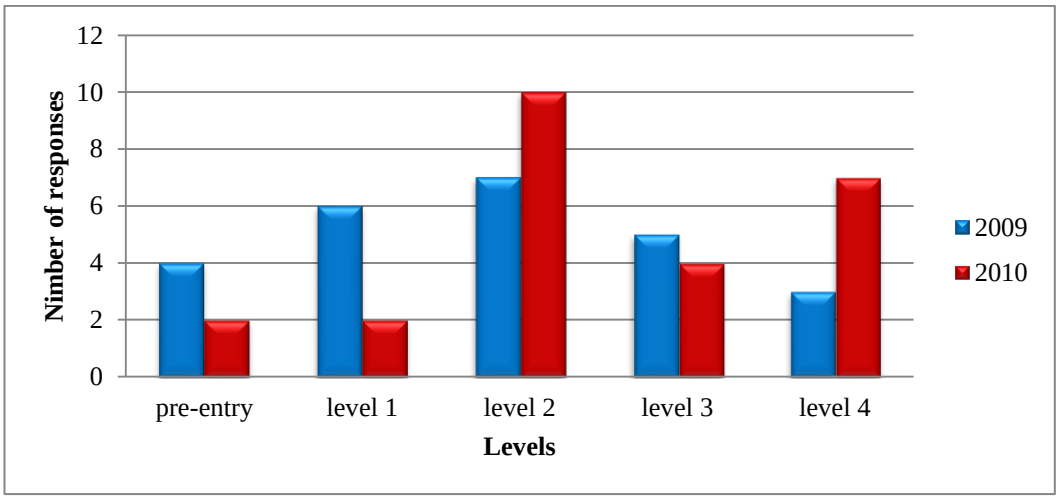

Figure 12: Student collaboration

From Figure 20 it can be noted that for the criteria on student collaboration there was a definite shift in 2010 with 40% of teachers indicating they were at level 2 or above. Level 2 states, you have started to think about how you could use ICT to allow students to discuss their work through to level 4 which is you design the use of ICT to maximise the engagement of all your students. At the beginning of 2009 four teachers (16%) indicated they were at the pre-entry level and at the same time in 2010 this number had reduced by two (8%)**.** This means only two teachers (8%) are still indicating they are at the pre-entry level for this criteria. In level 1 at the beginning of 2009 six teachers (24%) indicated they were in level 1 and by the same

time in 2010 this had reduced by four (8%) meaning only two teachers (8%) were still at this level. This suggests the strategy of using an ICT coordinator to support and mentor teachers may be a factor in supporting this change.

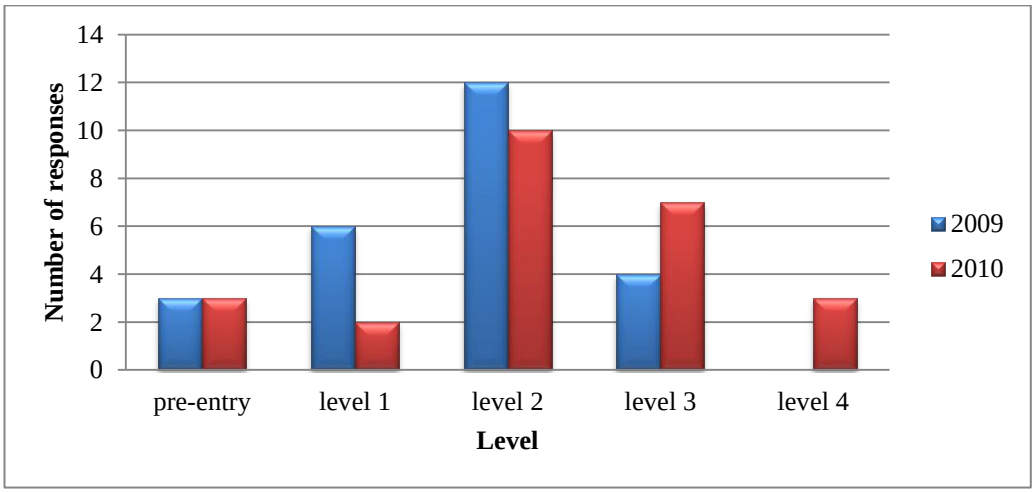

Figure 13: Enriching activities with ICT

From Figure 21 it can be noted that for the criteria on enriching learning opportunities using ICT, 80% of teachers indicated they were in level 2 or above. At the beginning of the study three teachers (12%) indicated they were at the pre-entry level and this did not change in 2010. However, in level 1 six teachers indicated they were at this level in 2009 and by the same time in 2010 this had reduced to only two teachers (8%) still indicating they were at this level. Of the twelve teachers (48%) who stated they were at level 2, at the beginning of 2009, reducing to ten teachers (40%) in 2010 an increase from four teachers (16%) in 2009 to seven teachers (27%) in 2010 stating they were at level 3. Three teachers (12%) indicated they were at level 4 in 2010.

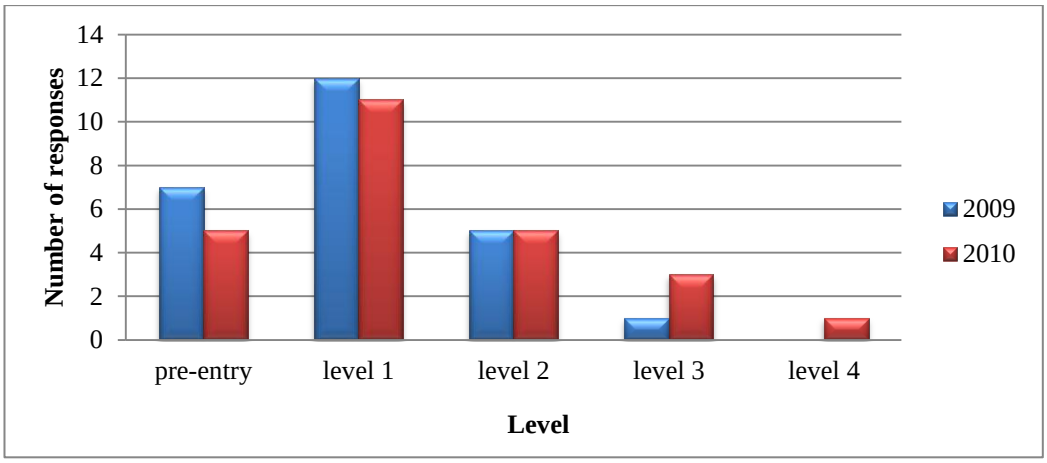

Figure 14: Monitoring progress

Figure 22, presents data for the criterion on monitoring progress. The results indicate the majority of teachers (64%) in 2010 were still grappling with the notion of using ICT as an assessment tool. The teachers indicated they do not use any ICT to judge what their students have learned or as having tried using ICT to replace some of their paper assessments. It is evident from these results this is an area that needs some input and the school may wish to look at this when considering future planning in the area of ICT integration.

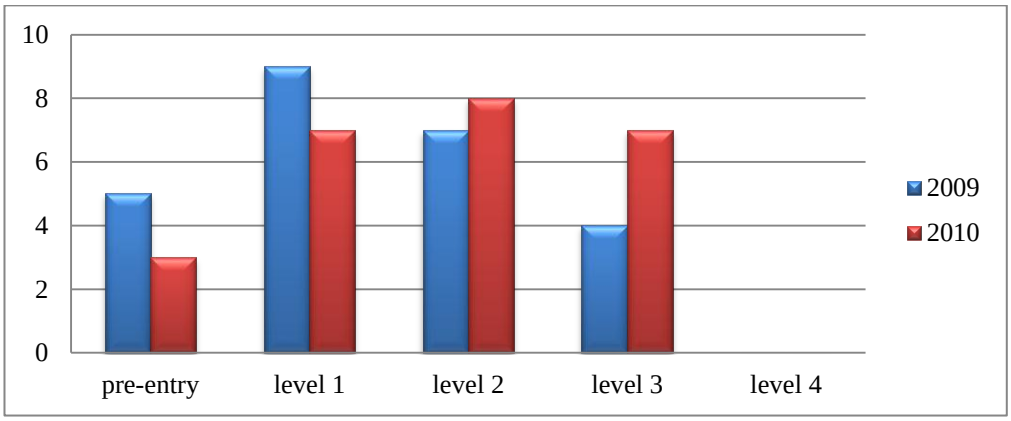

Figure 15: Using feedback

For this criterion 76% of teachers indicated they were around level 1 to 3. Level 1 means you have tried to use ICT and had some positive feedback from your students through to level 3 which states having used ICT a few times with different classes

and students have given you enough information to make their experiences better next time. It is evident from the results in this study that using feedback to improve student outcomes appears to be one of the strengths in this school.

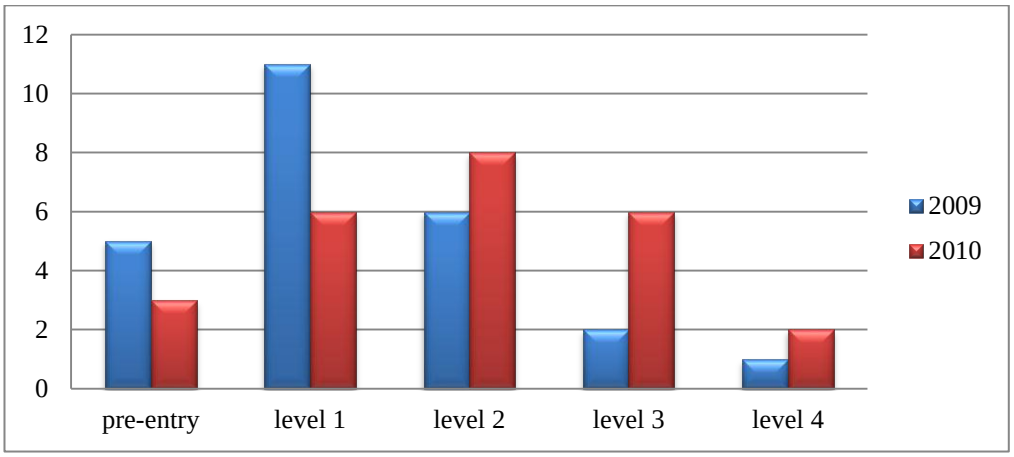

Figure 16: Student achievement

For this element on knowing what students can do**,** 80% of the teachers indicated being at level 1 through to level 3. From the beginning of 2009 until the same time in 2010 there was a general movement from the pre-entry level through to level 4. In 2009 five teachers (20%) indicated they were at the pre-entry level and at the same time in 2010 this was reduced to three teachers (12%) indicating they were still at this level. Eleven teachers (44%) stated they were at level 1 in 2009, and by the same time in 2010 there were only six teachers (32%) who stated being at this level. The number of teachers who indicated they were in levels 2, 3 and 4 increased by 2, 4 and 1 respectfully. Even though there has been some movement through the levels this result suggest teachers are still reluctant to encourage students to integrate their personal knowledge and understanding of ICT into their learning experiences.

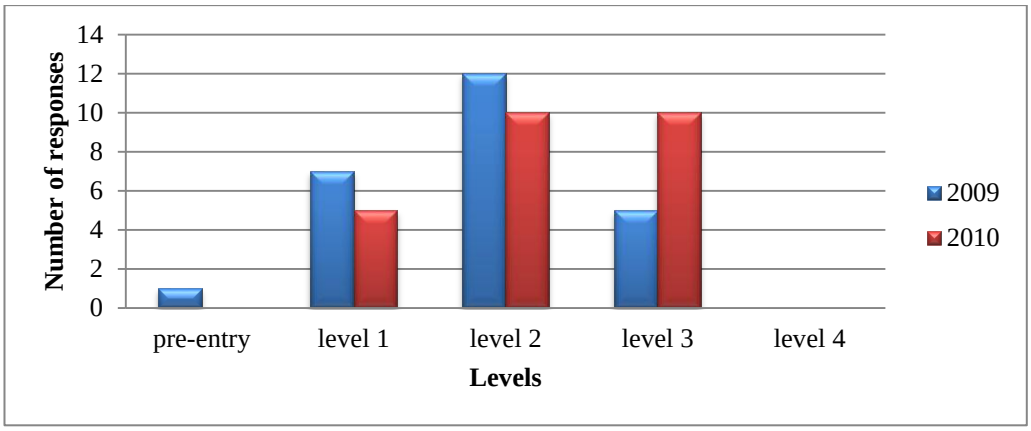

Figure 17: Personalising resources

For this statement 80% of teachers indicated they were either at level 2 and 3. For the former this this indicates teachers are aware there are a range of ICT resources available and they can use them to meet their student's needs and the latter level indicates teachers use ICT to tailor student's needs and, when necessary, access external support. This indicates teachers at this school appear to be comfortable with using ICT to supplement their teaching and learning programs. It is interesting to note there were only slight variations between the 2009 and 2010 results.

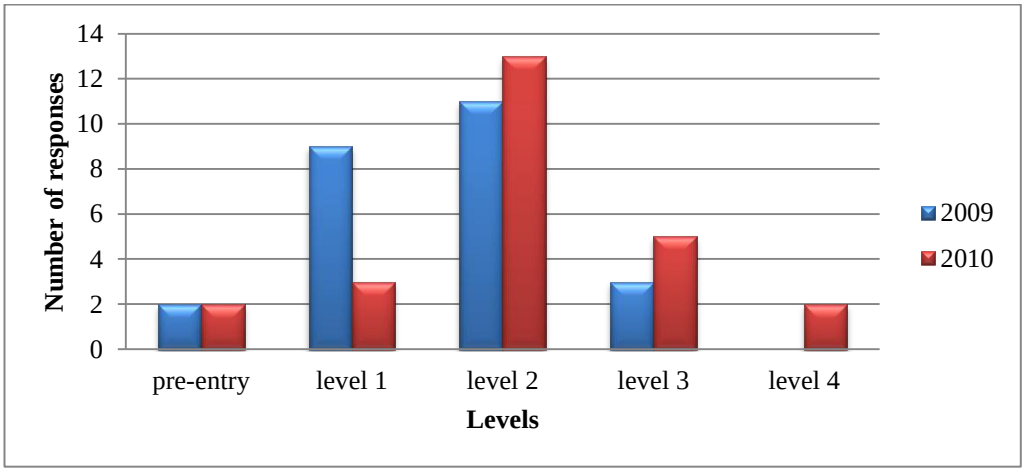

Figure 18: Students taking control of the technologies and their learning

For this question most teachers (52%) indicated they were at level 2, which indicates teachers let students use ICT to work independently. However, this suggests teachers may still need to develop an understanding of how to effectively integrate ICT into their teaching to promote quality learning.

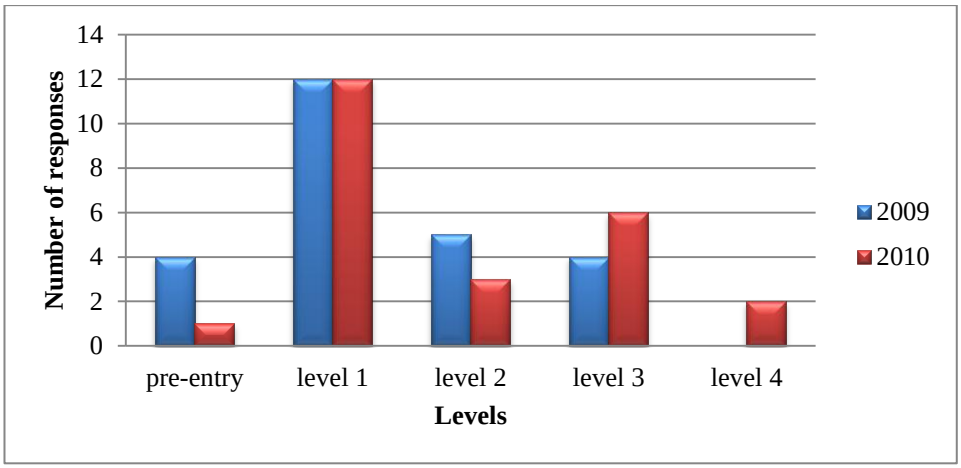

Figure 19: Helping students learn beyond the classroom

For this criterion, most teachers (52%) are at level 1, which indicates teachers have made themselves aware of learning opportunities beyond the classroom. However, there is a positive trend with 24% of the teachers indicating they actively encourage students to make the most of their out-of-class ICT opportunities. This suggests for this school, more work may need to be done in the area of developing teachers' skills in identifying and creating online learning experiences to take advantage of student's or students' ICT access outside of the classroom.

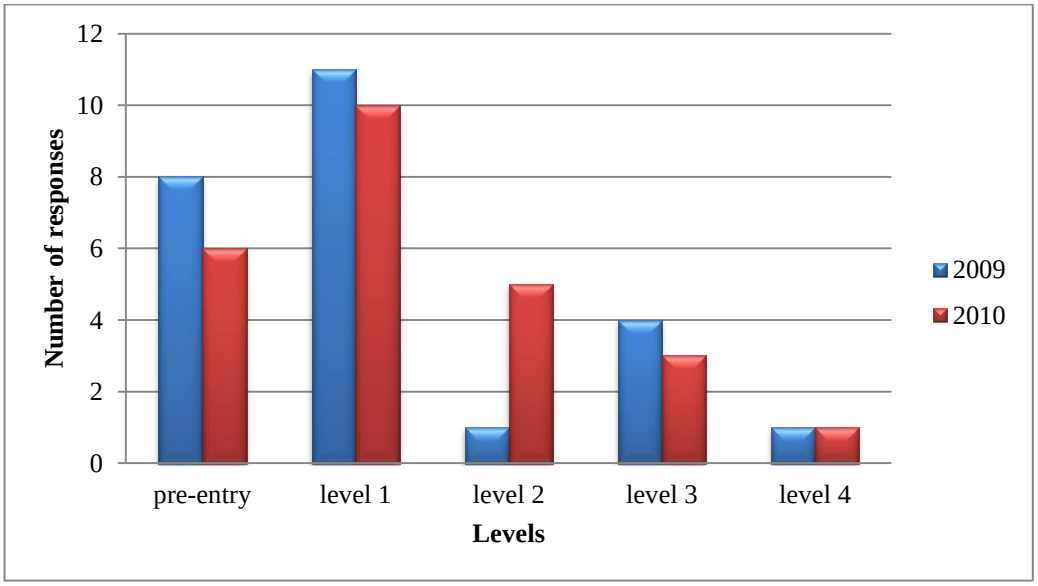

Figure 20: Teachers and students learning together

For this element most of the teachers indicated they were in either pre-entry or level 1 when it comes to learning together. This indicates teachers may have used some ICT to let people know about useful resources and to share tips, ideas and experiences with colleagues. This suggests for this school there needs to be a greater emphasis on a collaborative culture where sharing of resources and ideas becomes the norm.

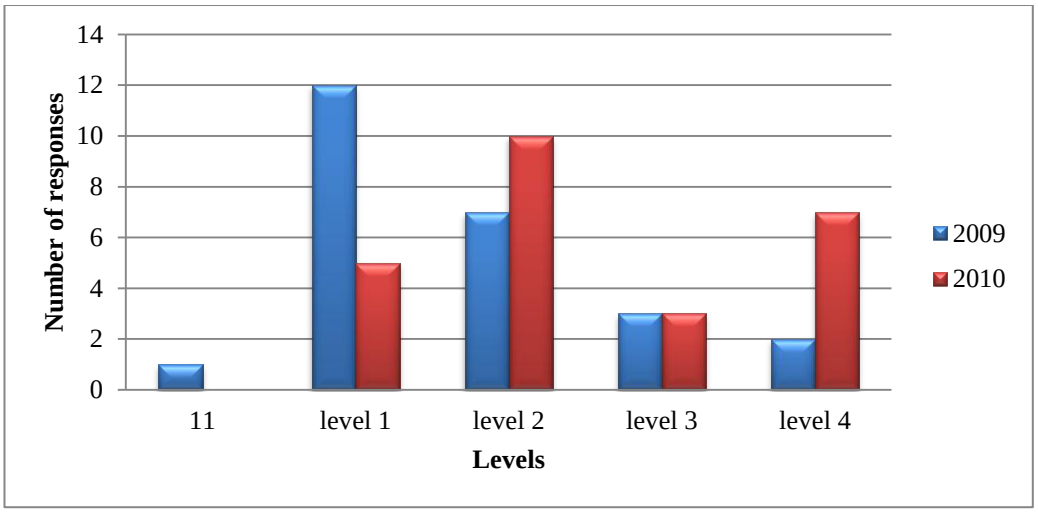

Figure 30: Teachers identify learning opportunities for students

For this component 40% of teachers indicted they were at level 2 which indicates teachers may use some aspects of ICT in their teaching because they have identified the benefits. However, there is a positive shift with 28% of teachers indicating they keep their teaching practices under review and adopt new approaches where there are proven benefits. This suggests teachers are slowly becoming more confident in their abilities to use ICT in their teaching and learning.

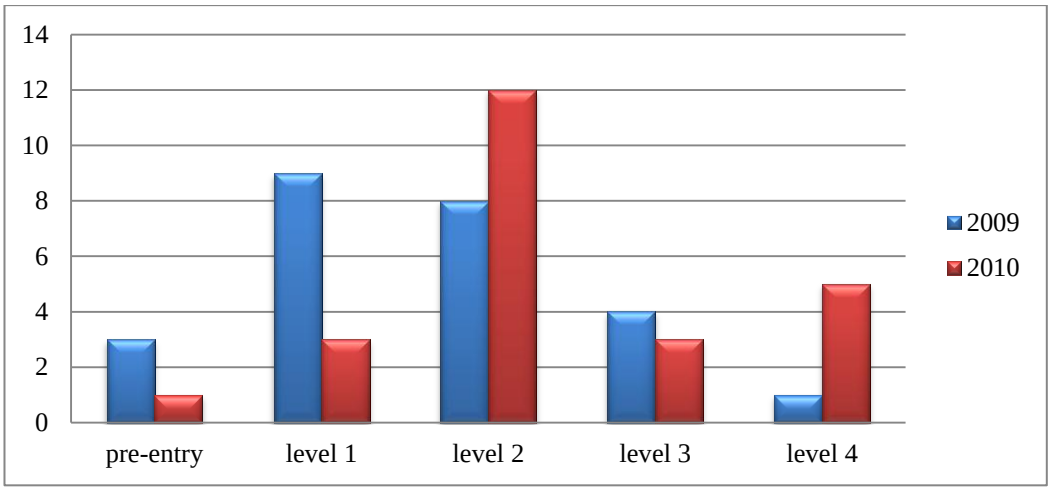

Figure 21: Teachers are staying fresh and exploring ICT integration

For this criterion, 52% of the teachers indicated they were at level 2 which indicates teachers have taken a few risks with their students' learning and have tried to use some new ICT to deliver an old lesson differently. A positive trend is evident in 2010**,** with 20% of teachers indicating they are in level 4 which demonstrates they are taking opportunities to experiment with their practices and evaluate how well things are going.

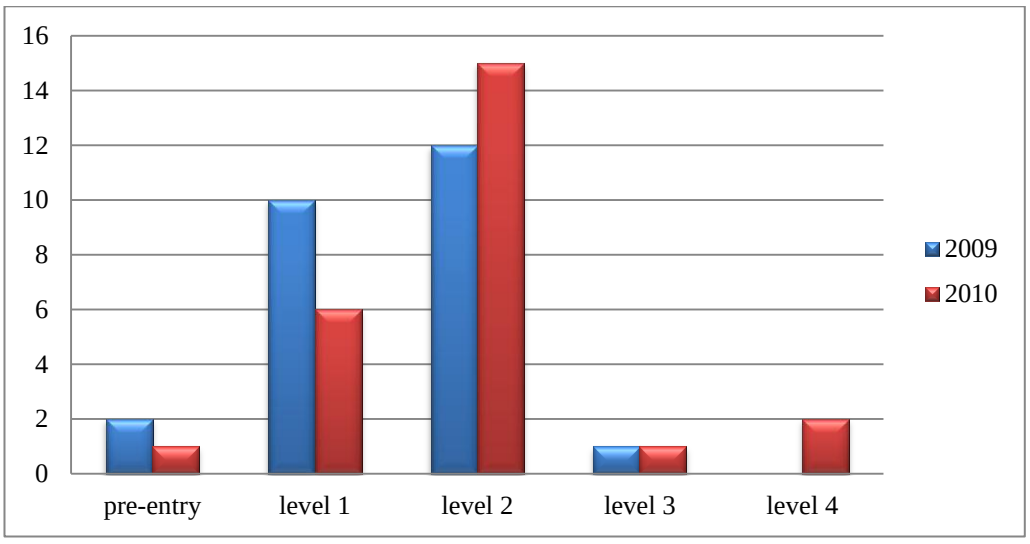

Figure 22: Teachers making recommendations to colleagues

For this question 60% teachers indicated they were in level 2 which indicates teachers make use of recommendations to colleagues and marking materials from educational suppliers. It is interesting to note teachers appear to be willing to make use of recommendations from colleagues and other sources but as indicated in Figure 26 are reluctant to pass on ideas and share their experiences. This suggests teachers may not confident with their own skills, knowledge and abilities when it comes to integrating new technologies into their teaching and learning.

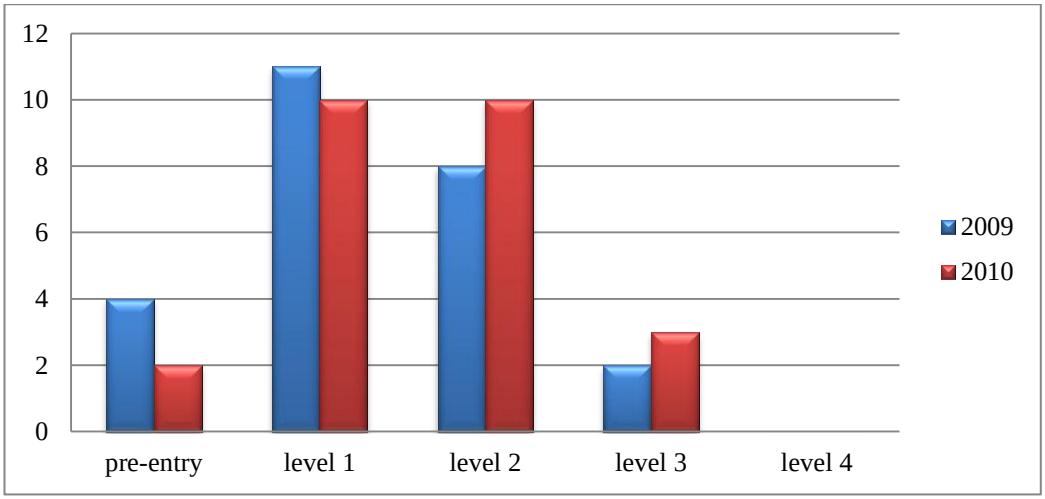

Figure 23: Teachers make time for teaching students

For the element of making time for teaching, 40 % of teachers indicated they were at level 1 which demonstrates that while teachers use school ICT systems they may not use ICT for personal administration. 40% indicated they were at level 2 which indicates teachers have started to use ICT for keeping records on their students. This suggests more work may be needed to up-skill teachers in electronic data collection so it does not disrupt their teaching.

4.17 Classroom observations

In this section the researcher observed the classroom teacher in action. After each observation the researcher spoke to the teacher concerned to ask questions and classify what was observed.

4.17.1 Classroom 1

Paul (pseudonym) is an upper primary teacher in a metropolitan primary school in WA. He has been teaching for 20+ years and during this time has mainly taught middle to upper primary (years 5 -7). At the present time, Paul teaches Year 7 and before coming to his current school some ten years ago, was a teaching principal in a small rural school in country WA.

In 2008 Paul exhibited an enthusiastic attitude towards integrating technologies into his teaching and learning. He requested an interactive whiteboard (IWB) and this was installed in his upper primary classroom, however, to date his use of the technology is limited and used it as an overhead projector. In 2009, Paul was observed delivering a lesson on large number multiplication. Paul was in the middle of the room standing next to an overhead projector but was focused on utilising an IWB surface. From here, he proceeded to demonstrate the concept of large number multiplication using an overhead projector on the IWB surface while the students followed along making notes in their pads. The students were unenthusiastic about this material, being keener to engage in non-ICT based activities that were prepared for the lesson. In a follow up observation, in term 3, Paul was once again observed presenting a lesson on natural disasters. For this lesson, students were viewing a 'YouTube' clip on Cyclone Tracy. During the lesson students were asked to take notes on important information gathered from the clip. At the completion of the viewing students were asked to write a paragraph what they know about Cyclone Tracy in their notebooks before going home.

At the interview, follow the lesson, Paul asserted that, under the current time constraints it was impossible for him to keep up with all the changes in technology. He responded

> *"I need to have time to learn how to use the IWB"*

After further inquiries about access to professional learning he responded it was available and he would "*get around to it one day*". He was also asked what other activities he used the IWB for and he said:

> *"It's great for showing DVD and film clips because the whole class can see and hear it without crowding around a small screen".*

Although Paul was positive about using technology in his teaching and learning, his knowledge and skills remained static. He sees a lack of time for professional learning and exploring the technology as his major barrier to making technology an integral part of his classroom.

In summary it was clear from the classroom observations and discussion; Paul wanted access to the technology but lacked the time to explore its true potential. Hence the resource was not being used effectively, the teacher was maintaining rather than changing classroom practice and the lessons were very much teacher directed.

4.17.2 Classroom 2

Marie (pseudonym) is a middle primary teacher who has nearly thirty years' experience in a variety of educational settings and age groups. She is currently teaching a year 5 class of 26 students. Marie's philosophy of teaching centred on providing students with the tools they need to succeed in life and to recognise and achieve their potential. However, in 2009 Marie was observed as she facilitated a lesson in the computer lab where students were working on creating a piece of prose. With each student sitting in front of a computer, Marie directed them to open Publisher. From here the students were directed to create a poem in response to the novel study they were currently undertaking. Throughout the lesson, Marie moved around the class directing students back to the task at hand and offering support as the students tended to focus on experimenting with fonts, graphics, backgrounds and boarders. Therefore, most of the class did not complete the activity.

After the lesson the observer asked Marie why she used Publisher to create a written document and not Word with which she responded:

> *"I like publisher and I use it for everything, therefore I get the students to use it as I know what the program can do so I can then pass this information onto the students".*

She was asked about her knowledge of other program such as Word for creating documents and she responded:

> *"I don't like Word so I won't use it and don't expect my students to use something I am not familiar with".*

Marie had a positive attitude towards technology and felt that it had the potential to transform her classroom by engaging students and enhance learning outcomes. However, she felt she needed more time to up-skill and develop her confidence to allow students to direct their own learning.

In Summary, Marie's experiences with technology and application of certain software packages have been restrained. Although she felt compelled to use technology it was evident throughout this observation the teacher (Marie) needed to be in control of the lesson and even though students were using the computers to compose their prose, Maria was reluctant to allow them to use a program she herself was unfamiliar with or did not personally like. Therefore, as a result she invariably fell back on what she knew which generally involved setting activities that involved using Publisher.

4.17.3 Classroom 3

Jan (pseudonym) is a middle primary teacher who has 12 years classroom experience. She has taught mainly year 4 & 5s and has been at her current school for her entire teaching career. Jan considered herself as a late adopter of technology and

stated her role as an educator was to create a positive learning environment that motivated students to want to learn and achieve their best.

In this middle primary classroom, Jan was placed at the front of the classroom next to the IWB. As the students came into the room she asked them to move their name onto an object displayed on the IWB as part of the roll call. Once the class was settled she clicked on a page that displayed what the day's program and/or lesson looked like before directing students to take out a math book and open up at the page for the day's lesson. This was the end of using the IWB.

At the conclusion of the lesson the researcher asked the teacher (Jan) why she used the IWB for roll call and nothing else. Jan stated she was only just beginning to use the IWB and the students loved moving their names around on the board at the beginning of the day so she was using as a treat. When asked if there were any other activities for which she used the IWB she replied:

> *I will soon but at the moment I have too much work to get through before the end of the year that I don't have the time to play with it.*

When asked what support was available to her, Jan stated she was part of the 'Partners in Action' program between the school and the local university and hopefully the pre-service teacher assigned to her, through the project, will be able to demonstrate how to use the IWB. Other than this, she didn't have the time and was not ready to attend professional learning as most of it was held out of school hours or in the holidays and she had other things to do.

In summary, it was evident from the observation and discussion with Jan that she wanted to be part of the program and liked the idea of having the technology in her classroom but was not confident in her own abilities to make IT an integral part of her teaching and learning. She stated she needed more support and time to develop

her ICT skills and felt stressed with other priorities and as a result become frustrated with what she saw as a constant push to use technology in the classroom.

4.17.4 Classroom 4

Michael is a mature age entrant with 10 years teaching experience at his current school and has always taught year 3. He described himself as a traditionalist and believes students learn best when given direct instruction and plenty of repetition. He is a reluctant user of technology and would prefer someone else to take the class for 'computing'.

During the classroom observation, Michael and students are in the computer room where there are 23 students and only 20 computers. He asked for students to volunteer to partner up during the lesson. Once the class was sorted Michael directed the students to open Microsoft Word and their saved story. From here he moved around the class, checking the students had their documents open and directed them to continue typing their pre-written stories. The students who were paired were asked to sit and wait until their partner has finished before they could work on their story. Whilst walking around the room and checking on their progress, it was noted by the observer that many students had not progressed very far and where spending a large proportion of their time changing the font size and text on the title of their story.

After the lesson the observer spoke to Michael about the lesson and the purpose of typing out an already written and edited story. He responded:

> *I just wanted the students to type up a good copy.*

When asked if the students had ever used the computers to compose a story or use the basis of their story to develop their vocabulary he replied:

No that would take far too long and some of the students would do nothing.

When the observer pointed out that some of the students could not find or possibly had not saved their work therefore they were sitting around waiting for someone to help before continuing he responded:

That's the problem with computers when kids don't know what they are doing they end up wasting time. I don't know a lot about computers so I can't help. I just bring them here once a week because that is what is expected.

When he was asked about professional learning he said that it was available but he could not see the purpose of taking part because he only had two computers in his classroom and another 12 in a mini lab next door so there was 'no point' since not everyone could be at the computer at the same time.

I don't really like using the computer and only use it when I have to at work. Personally if I could get someone else to take the class I would and when it comes to report time I usually get my pre-service teacher or others to type up my reports for me. If it wasn't an expectation I would not bring my class to the computer lab at all.

From the observation and discussion it was evident the teacher lacked the skills and knowledge to be able to support the students in his class. Throughout the discussion he appeared to lack confidence, have a negative attitude towards using technology in his teaching and could not fully understand how technology could support his teaching and learning program.

4.17.5 Classroom 5

Kerry is an experienced teacher with over thirty years of experience across all age ranges. She currently teaches a split class of year 4/5s. Kerry has been involved in professional learning for using IWBs in the classroom. Kerry states she has a love of

technology and enjoys experimenting with the latest gadgets. She considered herself an early adopter of technology and believes she was one of the leaders in the school when it came to technology usage and knowledge.

In 2009, Kerry was observed as she facilitated a language session in which the students collaborated to complete a series of rotational activities. She was observed as she skilfully led a whole class interactive whiteboard session using a combination of her own materials with hyperlinks to websites to stimulate teacher- directed learning. Kerry used the interactive aspects of the whiteboard by inviting students to engage with it, along with actively questioning students about the content.

On entering Kerry's classroom she is at the front of the class walking through the day's program on the IWB. The class start the day by moving their names around the board to indicate they are present. She then moves on to the schedule for the day and reminds students about library time and other events happening throughout the day before continuing on with the day's program. In the first session (Language) Kerry motivated the students by opening up a fun spelling activity with moving balls and she selected students to come out and move the balls in order to spell one of the words they had been studying. Once all the students had had a turn she moved on to the lesson for the day. On a new page she opened up an activity which had mix of new words and some of the previous words were down the left side with word meanings on the right. Kerry read through the list of words and all the meanings, and then she asked individual students to come and connect a word to its meaning. If a student was unable to match the word with its meaning they could 'get help' by clicking the word which was linked to a dictionary definition. The student read the definition then went back to the word and tried again. Once the activity was completed the students checked their answers on the answer sheet. The students then moved on to completing similar exercises in their language books.

At the end of the lesson the observer asked Kerry why she conducted the lesson the way she did and Kerry responded:

> *I had found that the students were more switched on when I used the IWB than if I just went straight into a pen and paper activity. The weaker students were more involved and all the students were motivated to come out the front and have a go. I also found that by doing a fun spelling activity or quiz at the start of the lesson students appear to retain more information and it seemed to set the tone for the lesson. I just love using the IWB and it makes my job easier. Mind you there is a lot more preparation for each lesson compared to the traditional lesson but I find the spin-off and enjoyment on the kids' faces worth it… after all that's what we are here for.*

In summary, after observing Kerry in action is was obvious that she had a passion for teaching and was willing to go that extra mile to make sure the students were actively engagement in the learning process in her classroom. Kerry exhibited competent ICT skills in the lessons observed and acknowledge the support she received from the ICT coordinator in preparing her on how to develop activities using the technology. She reported that her biggest barrier to successfully integrating technology into her classroom was finding the time to create resources and explore the internet for ideas, in context to other pressures.

Findings from classroom observations and discussions

Paul, Marie, Jan and Kerry all claimed to hold pedagogical beliefs that supported student centred learning and they exhibited positive attitudes towards ICT integration. It should be noted that Michael acknowledged that he was a more traditional teacher. He did not like or use computers in his daily work and only took the students to the computer lab because it was expected. The experiences of this group in using technology were inactive (Paul & Jan) faltering (Michael) or restrained (Marie) and developing (Kerry). None of the participants employed ICT in ways that enacted their pedagogical beliefs. Participants face a complex mix of constraints and when these are combined they contribute to a lack of creative use of ICT (Kleiman, 2004; Ertmer, 2005; Newhouse, 2010).

In the classrooms observed it was evident the teachers had adopted some ICT practices/use, but it is still very much teacher directed and controlled. In most cases the technology has not been used to give students a new way of learning, nor is there a change in pedagogical practices. Some of the teachers comments after the observations sums up the overall positive and negative attitudes of the staff when it comes to teaching and learning with new technologies. While some teachers incorporate technology successfully, it is still, to a large extent an opt-in system.

During a group conversation about using technology to enhance learning in early childhood classes the consensus from the early childhood teachers was technology is a useful tool for planning and preparation; however they didn't feel it had a place in early childhood with one teacher stating:

> *I use computers all the time to plan and research activities for my class. I would be lost without it, however having said that I strongly believe that they have no place in early childhood classrooms. Kids need to play and have hands-on activities whilst at school; they can do the computer thing at home.*

Whilst talking to a group of primary teachers Amanda commented:

> *Kids are all looking busy on the computer but productivity is not there. It takes them so long to do anything and you begin to wonder if it's worth it. They don't seem, on the whole, interested in doing anything in their own time…some can't even save their work in the right spot to retrieve it later*.

This suggests therefore, teachers will incorporate ICT into their teaching and learning as long as they can continue to use traditional teaching pedagogies (Truscano, 2005)

As stated by Kirscher (2003) in his keynote address at the 14th International Conference for the Society for Information Technology & Teacher Education

Teachers must find ways of harnessing the power of new technologies. Their jobs will change but their role should become no less important in the same way that public libraries and books did not make teachers redundant.

4.18 Summary of Findings

The classroom observation made in School A for this research indicated:

- Teachers are using ICT to varying degrees and the ICT coordinator is relied upon to 'come up with a lesson' for most of the teachers and lessons are skills related rather than curriculum integrated.
- Lessons in most incidences were ad-hoc with IT use having a very tentative connection to the lesson and its outcomes. Teaching with IT is mainly skill based, teacher controlled and directed with very little avenue for students to demonstrate higher order thinking.
- Early Childhood teachers don't place importance on exposing their students to new technologies and will skip the 'ICT lesson – taking students to the lab' if the ICT coordinator is not available or if there is a relief teacher in the room and they are running behind schedule. ICT is mainly seen as an extra thing to do rather than an integral part of teaching and learning. One early childhood classroom did not have a computer available for student use as the teacher did not want one in the classroom (see comment above) other than to be mainly used by the Teacher Assistant to create activity sheets and labels.
- Some of the junior class teachers do not expose students to the use of new technologies and if they do it is mainly for skill and drill type activities or as a reward.
- Professional Learning (PL) is not a top priority for most of the teachers especially when it is to be undertaken out of hours. Many stipulated in their performance management reviews they wanted PL in integrating ICT into their classroom practices but when it was/is organised they do not attend.
- There are seven interactive whiteboards installed in classrooms around the school, however these are not being used to their full potential.
- In most classrooms ICT is an 'add on' learning about ICT rather that learning with ICT.

4.19 Part D: Individual Anecdotes and Personal Journeys

This section will present teacher's stories about their journey with new technologies and the role it plays in their teaching and learning. This section includes ethnographic and auto ethnographic data.

Every teacher has a unique and individual story about how they adapt to the changing environment that makes up their teaching profession. They talk about the challenges and expectations they have experienced along the way and how new technologies influence and affect their future.

4.19. 1 Personal journeys

Teacher A is a teacher of some 25 years and during which time she has taught all year levels. At the present time she teaches year 5 and has participated in various professional learning opportunities involving technology. She is a mentor teacher for pre-service teachers and an active participant in the 'partnership in action' project with the local university. This project is a reciprocal teaching project whereby the in-service teacher mentors the pre-service teacher in educational pedagogies and the pre-service teacher supports and mentors the in-service teacher in adopting new technologies.

Teacher A – My ICT Journey

> *My first use of computers was in the mid 1980's when my previous primary school, set out to do reports on computers. In that era we were using a Commodore 64 with 5 1/4 inch floppy disc. We had to make a data bank of comments for each subject area to go with a score ranking 1 – 5, and then assign a number to each child for each subject. The reports were then generated by the office staff. This was not an ideal beginning to my use of computers as I found the limitations of the C64 very frustrating and the reports were not accepted well by the school community. We then went on to use the C64 for some classroom use including LOGO and a few English/Maths games that the school purchased and publishing of children's stories, but one computer between 5 classrooms was very limiting and after a year of*

experimenting and frustrations I thought that computers were a total waste of time in the classroom.

On moving to my current school, I had a computer in my Year 1 classroom, but, as before, I found it very limiting for use between so many students. Most of the time they just played "educational games" before school and I used it for publishing the children's writing. So, once again I was frustrated with computers and didn't put too much effort into exploring their uses.

At this stage I didn't even have a computer at home. After an injury to my writing hand, I purchased my first computer for home use so that I could type my subject programmes, daily work-pad and make worksheets. My first bought software package was Publisher as this easily allowed me to design a format for my programmes. This was my only home use of computers for quite a while.

In the late 1990's my school decided to move ahead with technology and provide an ICT lab where there were to be 15 computers all with internet accessibility. I also moved classrooms and now had two computers in my room for my Year 4/5 students. This is when my journey really evolved. I found that I could purchase good educational products with Alternet CD ROMs and links to internet websites, the main producer of these products being Ready-Ed Publications. So with this as an inspiration, I set off to integrate ICT into my science topic "Insects and Spiders". At that stage we had an ICT teacher who taught the children how to use the various applications and programs that were on the computers into the ICT room so I didn't investigate this side of things very much. I scheduled an extra hour in the lab and embarked on this new way on using computers. The children were totally focused and the unit on "Insects and Spiders" was so well accepted that I quickly purchased another book so I could continue. The two computers in the classroom were now being used throughout the day with either research on the topic via the internet or publishing their written work for display.

My personal use still wasn't very extensive and I basically used the computer as a typewriter with a printer for all written tasks, including reporting to parents. I started using the internet to find websites suitable for my class, but with a dial up modem being so slow and costly, I soon gave this up and a bad idea.

Another move within the School in 2003 put me into a Year 5 class in another building, again with only two computers. The teachers in this cluster were approached to see whether they would rather the computers be removed from the classrooms and moved into the central wet area. And so, a mini-lab, adjacent to the main ICT lab, containing another 12 computers was established. I could now send out half my class at a time to do research while the rest worked in the classroom, plus with the ICT teacher program no longer available, I had to start teaching the children how to use computers and computer programs. This in itself forced me to spend time, sometimes I'd only be one step ahead of the children, to learn how to use computers properly and extend my knowledge of the various software packages that were installed on the server. I guess this is the stage where I knew that computer use for children was going to be an integral part of their lives and it was up to me to keep up with the technology.

The Department of Education started offering laptop computers with internet connection to teachers on a lease basis. I promptly signed up and this gave me more incentive to investigate the internet. I must have spent hours searching for good sites for the children to use but gradually I refined my search techniques so that the number of "hits" I got was greatly reduced. I also started using the internet for professional development and did a lot of reading about integrated computer use. With the introduction of broadband at home, I was able to spend more time on the internet to research different sites to get good ideas for integrating ICT into my classroom.

In 2008 the first of our "Smart-boards" were installed in our school, plus a mobile one was purchased. I guess I wasn't that excited by it at first, nor did I understand its capabilities. In 2009, I attended an in-service called "Smart-bugs" and my eyes nearly popped out of my head. The applications for this Smart board were infinite and I thought "I have to have one of these!" I borrowed the mobile Smart board and started to investigate how to use this board with my class. Half way through 2009 a Smart-board was installed in my classroom and it was there that I really saw the capabilities of these boards. Most of the children in my class had come from Year 4 classes where the teachers used a Smart-board and they were my teachers until I had grasped the basics. I spent many hours investigating different internet sites for Smart-boards and found the readily available resources quite extensive for every subject. I attended several more "Smart-bugs" at various schools and got more

ideas and inspirations. Every day I was using the Smart-board more and more. I developed a classroom home page that contained instructions and details for the children when they came to class and all my day's work was on there as well. My only frustration at one stage was that my leased computer kept crashing during lessons, but after that was finally fixed it was full steam ahead. The children were always excited with the resources I found to use on the Smart-board that integrated with the curriculum I was teaching and I must admit it made the lessons so much more exciting. I was surprised and delighted by the speed in which they learnt new concepts after being involved in Smart-board activities. I cannot imagine ever being in a classroom without one of these ever again.

Where to from here? Well that's an interesting and exciting question. I guess the best would be for each child to have his/her own laptop. Perhaps one day, our school may even venture into leasing laptops for classroom use. To have the children working individually on programs would be such a valuable tool. I'm not saying that they would use it all day every day, but there are times when it would certainly be an advantage for the children to have one each. I have found some excellent sites that cater for individual learning, for example: smartkiddies.com for maths, spellingcity.com for spelling, and the use on NAPLAN online would be advantageous when training the students for these tests. To be able to have the children regularly publishing their own writing and researching online using their own laptops would also be beneficial. As for me personally, I am involved in SOCS, LWICT and the partnership program with Edith Cowan University with trainee teachers. SOCS has opened up a new idea to me and I eagerly wait to use some of the ideas with my new class in 2010.

And so, in the space of 20 something years, my ICT journey has evolved from one of thinking computers were a waste of time in the classroom to where I wish every child had their own. Personally, I now use the computer more than just a glorified typewriter. Looking back on my journey has made me appreciate the way technology has advanced and how I have adapted to this change. The future is unknown but I know it will be an exciting and eventful one as we move further ahead with technology.

It is evident from this teacher's story she is committed to the educational needs of the students in her care. It was interesting to note how she has reflected on her journey and over the space of a few short years' has changed her opinion from "computers being a complete waste of time" to feeling that even though the future is unknown she is excited about the prospects and the future of new technologies in education.

Teacher B - My ICT Walk or should I say crawl!!

Teacher B is an experienced teacher of some 32 years during which time she has taught mainly in the middle to upper primary levels. This teacher has been at the same school for over 25 years and is currently teaching year 6. She has participated in some professional learning opportunities involving technology, and is a mentor teacher for pre-service teachers and an active participant in the 'partnership in action' project with the local university.

> *I think my computer interest started when I found out you could correct wrong spelling without having to start a new page as you did with the typewriter!*

> *At the time computer started appearing in schools and I got to have a look and maybe even a play on it, they were hugely expensive and something I didn't think I would be able to afford for a long time. I could see it would be something that would definitely go ahead and be a necessity in the future and a whole new language was developing but I still did most of my work either by hand or on my portable typewriter that luckily had a corrector on it.*

> *I'm not sure exactly when I got my first computer but I think it was about 1990. We were starting to use them in school and I could see the benefits of having one. I know it was a 486SX… a huge monstrosity of a thing that was very, very slow by today's standards but extremely fast for those days. In order to get it my father loaned me the $3 000 it cost. I also managed to get a dot matrix printer where the paper ran on "tractors" with holes in the side of the pages which tore off after you*

had printed. We used these big black floppy disks and you had to turn a lever to hold the disk in the slot.

I mainly used the computer for word processing, something I guess I still do. I would create worksheets and letters using the computer. I started using it for keeping personal records of tax item records and the like. I also bought programs for my kids to use, like "Reader Rabbit". I don't have much recollection of how we used computers at school but again I think it was for word processing and I think for the kids to use to play educational games. There were not many computers in the school.

As programs became available and other people showed me how to use them, I became more interested because I could see how useful they could be and how much time they would save. They were also useful for storing information.

I guess I would say that I have followed the progress of computers but by no means have I been a trail blazer. Once I see how I can utilise a program to make my life either easier or more interesting I follow up on it and try to learn how to do it/use it. I have done most of my learning about computers by other people showing me what they do or by teaching me how to use something that interests me. I have never done any reading or research in relation to computers.

My main motivation for updating my personal computers has usually been efficiency and when they bring out a new computer that goes faster or has a program that runs more or better things then I generally update. For the past few years I have been leasing my computers. It seems that technology is advancing at a very rapid rate and when I did outlay the big bucks for the computer, it was out of date within a short time, so would be relatively worthless to try to sell second hand when I wanted to update. I have found the leasing arrangement suits me quite well. I keep a computer for about 3 years and then update. I have no old computer to dump or get rid of and I can claim the lease payments on tax.

Work has helped my knowledge and experience with computers evolve as I have found a need or a use for computer technology that develops.

Getting the internet was probably the next step after deciding I wanted a computer. Initially I had an extension telephone line running to my computer so I could use a "dial up" connection. The draw back there was that if anyone phoned our house the internet would be cut off. I know I could have made it so that it didn't do that but my husband wouldn't let me. I would spend lots of time on the internet (as the computer was so slow) so he said I had to make sure people could get through if they wanted to. Once we moved into our new home (1996) we got ADSL straight away as it was part of a package that was offered by the developer of the area we lived in. That was so much better as we then had a dedicated line and there were no cut offs. It was also a lot faster than dial up. I also went from a black and white printer to a colour printer.

After becoming involved in a small business run from home I found I needed to have a reliable, efficient and up to date computer as I was communicating/liaising with "head office" in Sydney. I then not only did word processing, emailing, internet research but then scanning, digital photography, Skype, face booking and web cam (2001). I now have wireless connection at home which has proved useful when wishing to show people things or more than one person wanting to use either or both a computer and the internet. I have attached my computer to my TV at home and developed skills to utilise this technology too. I access the computer on a daily basis both at home and at school.

I have an i-phone which is also a mini computer. I have found this easy to use and understand. I am sure I don't use all the facilities the phone offers but I use quite a few of them.

With regards to work, I think I have just moved along with the times as they have changed. I have attended a few workshops but have mainly learned things along the way on a need to know basis. As something new has come along I have embraced it with caution. I mean I become interested but don't just rush into learning about it, rather I sit back and see how others are using it or doing things with it and suss out its usefulness for me and then go about learning how to use it or implement it for myself. I don't like being the "guru" but would rather be the "good student".

When laptops were offered to staff by the department I took the opportunity as I could see it would be a useful tool both at home and at school. It has taken a while for it to be a necessary part of daily school life but I believe it is now the right time to have a laptop permanently in my classroom. Although there are quite a few computers around the school it is important and efficient to have a laptop in the classroom and use it during daily tasks. The difference came also when the school gained wireless access. I am now able to access Integris™ and fill in my roll each day, rather than write it on a piece of paper and then transfer to Integris™. I am able to make notes about individuals in my classroom which are safe and secure and cannot be accidentally accessed by anyone else. I am able to send/receive communication to other staff, principal, district office and the like. I am able to access the education department site and all the resources it has. I am also able to communicate with parents by email now.

I have attended LwICT training and am curious to keep developing my knowledge and expertise in that area. I am happy to show and explain to others any knowledge and/or skills I have acquired along the way and have recently taken the plunge to have a Smart board installed in my room. I am extremely 'green' in my knowledge of its use but am keen to explore it application and usefulness in the classroom. I think the only way you can really get to understand and master it is by using one. To this end I have also volunteered to work as part of a partnership team (with ECU) to team up with a pre-service teacher to learn together how to 'use' the Smartboard in the classroom to enhance student learning. As I begin to try to put things together to use in my classroom, I find I get very frustrated as I want to be able to do it straight away but as it is a relatively new type of technology (and very new to me) there are many things I have to learn and understand.

I believe that you have to move with the times and continue to keep learning and developing ICT skills as this area is moving very quickly. I find that I only really learn the things that I need to learn which help me in my home and working life. If I am not continually using programs or facilities I tend to forget how to, so I guess the learning on a need to know basis is probably the only way I will succeed.

Teacher B has a different approach and outlook on technology than the previous teacher. She openly admits she is not a 'trail blazer' and must see the need/purpose of implementing technology into her teaching before doing so. This teacher gains her knowledge through being mentored by others and becomes easily frustrated when things do not go as she has planned.

It is interesting to note, even though Teacher B likes to update her computer regularly and enjoys having the latest gadgets for her personal use, she was not so keen to transfer that philosophy into her teaching and learning. She is not confident in her abilities to make new technologies an integral part of her teaching and learning and finds it frustrating when things do not go to plan. Her lack of ICT knowledge may be making her anxious about using ICT in the classroom and thus not confident to use it in her teaching.

What is interesting to note are the similar themes identified through each teacher's recount of his/her journey with regards to teaching and learning with ICT. These emerging themes will be presented in tabular form later in this chapter.

Teacher C- My Interactive Whiteboard Journey

Teacher C is an Early Childhood teacher at a level 5 metropolitan primary school in WA. She has been teaching for 15 years and during that time has taught from K-3. At the present time she is teaching a split class of year 1/2s. This teacher has participated in a number of professional learning programs involving ICT. She is a mentor teacher in the 'Partnership in Action' program between her school and the local university.

> *About 4 years ago, I went to a K – 3 network meeting and saw a demonstration of an Interactive Smart-board. At this stage, I thought it looked great and was something I would love to have in my classroom so as to allow me to more readily cater for different learning styles and*

also motivate students. I also thought it would be very useful during group activity tasks. Funding was a potential problem which I thought would stand in the way of me ever getting one in my classroom. Between then and now, I have attended a number of professional development sessions both at school and out of school on interactive whiteboards. During Term 3 2009, I had the opportunity to sign up for an Edith Cowan University Partnership Program and not only have one in my classroom, but receive ongoing training from future Practicum Students in its use.

During the Term 3 2009 holidays, I attended a professional development on how to construct activities on the interactive whiteboard. I found this idea incredibly daunting as I felt the idea of "programming" technology was out of my skill set. However, I was pleasantly surprised to find that it was not difficult at all. In fact, by the end of the day I had produced two activities by myself and was keen for more. I really feel that if I can do it, with my level of confidence in manipulating computers and technology, then anyone can!

Once the portable interactive whiteboard arrived in our classroom, we needed to call upon Val to assist in the initial setup and installation. After this, my student and I thoroughly enjoyed having this resource in the class and worked together to deliver Mathematics, Language and integrated curriculum activities initially.

The Mathematics activities included manipulating a clock to show the correct time; Fractions; Space; and Money. While the Language activities included; Fill in the missing words; Classifying words; and Cinquain poems. The integrated curriculum activity was a roll calling and continuous line drawing activity that slowly revealed a picture on a subject that we were currently learning about. The children were all very eager to use the interactive whiteboard and remained on task, they were disappointed when they came into the classroom and it wasn't our turn to have the interactive whiteboard.

I envisage myself using the interactive whiteboard during most aspects of my teaching, particularly during small group Language and Mathematics activity time. I would also like to further my knowledge and usage of it by attending further professional development and using

online resources. I am also looking forward to sharing what I have learnt with other colleagues.

As one would expect, this teacher's personal recount is different to the previous teachers' stories since everyone perceives their experiences differently. This teacher is enthusiastic about the potential of technology and can identify the benefits of making it an integral part of her teaching program. She has a positive attitude toward using technology and is prepared to source her own professional learning opportunities outside of the school. She is confident and willing to share her ideas with colleagues.

Teacher D My ICT Journey

Teacher D is an experienced teacher and administrator of 32 years. She has taught in a number of country schools and more recently in metropolitan schools. She has undertaken post graduate studies in learning technologies and participated in various professional learning opportunities. Teacher D has also conducted at her own school professional learning opportunities for staff and visiting teachers. She is very motivated and enthusiastic about the prospects of making new technologies an integral part of the teaching and learning experience for students.

My ICT journey began in the mid-1980s when the first BBC Acorns arrived in the government primary schools. During this time I had purchased an Amstrad computer and was learning how to program this machine, when the principal asked at a staff meeting was there anyone who knew anything about computers. From that point forward I was deemed the computer expert. By the late 1980's I had traded in my Amstrad for a PC. It was a 386 and at the time was the latest in personal computing. I can still remember the sales person telling me that this machine with its 120 megabit hard drive would be all that I needed for the next 10 years. How things have changes over the last 20 years. Although computers were not widely used in schools at the time I was able to help introduce them as I had gained some experience through my own curiosity and exploration.

In the early 1990s I was appointed acting principal of an Education Support Centre and the internet was just coming into vogue and it made a major impact on the way I delivered my teaching and learning programs. It was at this time my interest in using technology to support student learning really came into its own, as I could see how it could be used to level the playing field for student with disabilities.

By the mid 1990's the internet had become a major focus and I was lucky enough to be part of the train the trainer program for the internet in schools project. From here I was promoted to principal of a small country primary school and played a major part in bring that school on-line and training staff and school community in the pedagogical justifications for using ICT in their teaching and learning.

In 2003, after gaining a transfer to a metropolitan primary school I enrolled in a post graduate course about teaching and learning with ICT. This course was run by a local university and after completing the two year course decided to continue on with my professional learning in this field and completed a Master of Science specialising in technology education. I am now an Associate Principal based in quite a traditional primary school and as part of my role I am the LwICT coordinator and it is my role is to bring the school into step with major changes in pedagogy in the 21 Century.

In this teacher's story it is obvious that she has a passion for new technologies and making it an integral part of the teaching and learning program to enhance the learning opportunities for students.

As can been seen through the different journeys, each teacher has a different story to tell. However, it can be noted that even though the stories differ the factors identified by these teachers such as share common ground.

From all of the personal stories told, it is evident teachers learn in a variety of ways, just as children do and that everyone has their own way of achieving the end result.

What is important to remember is that we now have the technology in our schools but we must decide if we are serious about making it an integral part of the educational opportunities schools provide for students!

4.19.2 Interviews

For this study, teacher where asked to volunteer through the questionnaire process if they were willing to take part in an interview. Once the information was received volunteers were contacted to schedule suitable meeting times. As a result four teachers and two administrators were contacted and interviews were carried out. These interviews were conducted at three schools (Level 4 and 5) in different locations (rural, urban & metropolitan). The teachers in this study were fairly representative of all the teachers across primary schools in WA as measured by the Teaching and Learning questionnaire (Appendix B) and by comparing their results with observations and comments made by the participants in the study.

Interviewee 1, who for the purposes of the study was assigned the pseudonym Alison, is an experienced teacher (Level 3) in a brand new level 5 rural country school that is well equipped with technology having interactive whiteboards in each classroom, plus three desktop computers and a class set of wireless notebooks. She had been teaching for many years taking leave to raise a family before returning to the profession. She came back in the early nineties just as technology was being introduced into schools. Since returning to the professional Alison has taught in the junior primary area as well as training to be a LWICT (Learning with ICT) coordinator. She has a passion for student centred learning and exhibits a positive attitude towards technology integration.

Interviewee 2, known in this study as Brice (pseudonym) is a classroom teacher and ICT coordinator in a level 5 outer metropolitan school. He has been teacher for more 15 years across the metropolitan area. Brice's philosophy of teaching centred on providing learning programs to enable student centred rich educational experiences relevant to today's needs and for the future.

Interviewee 3, known in this study as Irene (pseudonym) is a beginning teacher in a level 4 rural school. She has been teacher 6 years in her current school. She describes her teaching philosophy as challenging students to become self-motivated learners, whilst providing students with the tools they need to succeed in life and achieve their potential.

Interviewee 4, known in this study as Rodney (pseudonym) is an experiences administrator in a Level 5 country school. He has a very positive attitude towards teaching and learning with ICT and holds a strong belief in distributive leadership and promoting social capital in staff.

Interviewee 5, known in this study as Jan (pseudonym) is an experienced administrator who had many years' experience working in many country and metropolitan schools. She is passionate about using technology as a tool for enhancing learning outcomes for all students.

Why use technology?

A strongly held view was that new technologies should only be used if they result in improved learning outcomes for students and not just an add-on to traditional pedagogies with which teachers are familiar. According to McKenzie (1999), Farrell (2003) and Balanskat, Blamire & Kefela (2006) teachers who are reluctant adopters of technology need to be convinced the results from using the resource would be expediential in enhancing learning outcomes. This was supported by the following quotes from teachers interviewed in this study.

> *Most of the staff who are reluctant to integrate ICT in their classrooms, did not have them as a teaching tool at the beginning of their career some 20 years ago and are too scared to do so mainly because they feel 'dumb' in doing it (Rodney).*

I think some teachers are reluctant to integrate ICT into their classroom because they don't know what they are doing, they feel really inadequate about using it, they are used to being the person with the knowledge and now they can't admit that they can't utilise a strategy or use a resource can be very embarrassing and humiliating in front of the classroom.. I guess some of them have not seen how powerful it can be in the classroom or they see it as another thing that they have to teach kids rather than just another resource that you use when you are working with kids (Jan)

I believe that teachers are reluctant to integrate new technologies into their teaching and learning because they don't see the real purpose or benefits from using it and they feel out of control because in most cases the students know more than they do (Brice).

I think with my personal ICT journey it started with a lot of fear and it started with a big feeling of embarrassment… I should know how to do this I am a teacher… and a sense of not knowing where to start and not knowing what I had to learn or how to learn it. I remember very clearly feeling quite lost which has been a very good thing when I am working with other staff to have experienced that. I needed a great deal of encouragement and patience and because I was given that I am able to employ those things when working with staff. Whenever I have worked with staff who are really struggling with ICT, I see my role as encouraging, supporting and helping them find a way in which this means something to them giving them a purpose for using it and it is usually a person purpose – go hunting for something on the internet before even trying to use it in the classroom and I use those strategies because that is what worked for me and they were very powerful for me in my own journey (Alison).

So why integrate technology in teaching and learning? Many researchers have concluded that technology can improve the quality of teaching and learning opportunities and enhance the learning outcomes for students. Therefore it is important teachers adopt new technologies as part of their pedagogy. Teachers in this study support this through the following comments.

I use technology on a daily bases whether it be the Smart IWB and or digital cameras, depending on the activity we are doing I also use

TV/DVDs and movie clips, calculators and CDs as a way of motivating and engaging the students into the topic under investigation. I find that the technologies give me another avenue in which to engage my students in the learning and in many cases the students are more inclined to participate in the lesson when the technology is being used (Alison).

I am what you would call an early adopter of the technology because before I switched to main stream teaching I was a Special needs teacher for ten years and technologies became an integral part of the teaching repertoire to support these students in their learning. Over the years I have moved away from traditional teaching pedagogies and more towards a student centred and inquiry based approach. I integrate various strategies from six thinking hats, Blooms taxonomy, Multi intelligences and Habits of the mind. These strategies along with cooperative learning are well suited to the use of technology (Jan).

The teachers in this study also felt there were no incentives for teachers to become proficient in their use of ICT because in most cases the expectations were not there.

We do not have incentives for staff to become more proficient in their use of computers as they (mostly) leave this up to me (Brice).

Many teachers don't see the importance of exposing students to technologies especially in the earlier years therefore where possible they don't give students access to these. Many times the teachers will forgo taking their class to the computer lab for computer and even those teachers' who have IWBs in their classrooms don't access them basically because they see it as a luxury and they don't have the time or skills to make it an integral part of their teaching (Rodney).

Even though we have quite a bit of technology around our school it is not a priority and teachers tend to leave it up to the support teacher or someone else to teach the students about technology. There is no great expectation from the school leadership that we integrate technology it is up to the individual to do so (Irene).

It is now getting to a point where you cannot do your job unless you are ICT literate and I have worked with some staff who are basically on their last professional legs because they couldn't get this ICT stuff mastered. If you don't adopt new technologies you are going to have to withdraw from teaching. It has really got to that point because you have to do attendance, reporting, and all your communication comes via email now. If you want to attend professional learning you have to register on line, all the communications and information is sent out via email you don't get a letter. So the incentive is if you are not using ICT you are only getting probably a third of your professional life and I would say in ten years' time it will be down to almost nothing (Alison).

What is the pedagogical justification for investing in new technologies?

Pedagogy represents knowledge, skills, classroom management and overall effective teaching practices. It is a complex blend of the teacher's professional knowledge, skills and pedagogical beliefs and values that play an important part in shaping technology mediated learning opportunities. This is evident from the following comments.

This school is not as advanced in integrating ICT into teaching and learning as it should be. The Principal and some staff members are looking at a variety of ways to address/improve this (Brice).

Most teachers use the computer as a reward or time filling exercise for students who have completed other work, whereas I have a new task for students to go onto if they have completed the set task ahead of time (Irene).

I set tasks for the whole class and then accept a standard comparable with ICT ability of each student. I move around and spend as much time with each child as possible, asking them to think more about the process of what they are doing so that the associated skills are being developed (Brice).

I really like to engage kids in active learning, cooperative learning strategies… I like creating a real context for learning or taking as many

real contexts in the daily running of the class so that they become really good teaching opportunities things that arise naturally. I think the reason that I love technology is I can at a click of a finger create a real context in my room and I used this a lot when I was teaching my 'special needs', which is where I began my ICT journey (Alison).

I use ICT constantly in my classroom , the children do their roll before they come into class, by a click and drag method it's used on-going throughout because it is an electronic whiteboard it doesn't get switched off, we do mute the screen and take it down to grey screen but it never gets switched off and we have activities through-out the day that we planned to user the whiteboard for but we often have incidental use of it as well were we'll start talking about something and the kids will get engaged and a particular questioning line and we will quickly Google and pull stuff up and work through so it's constantly being used (Irene).

From the Teaching and Learning questionnaire (Appendix B) there is evidence of teachers who are starting to integrate new technologies into their classroom practices are delighted with the impact these strategies are having on student outcomes. These teachers have moved through a steep learning curve and endured frustrations; however, they persevered and are reaping the rewards for their efforts.

As students' progress through the year levels, they will spend more time engaging in collaborative work and participate in more project-based instruction. Through these programs, students can direct their own learning and readily engage in problem solving and critical thinking (Brice).

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> *It is absolutely vital to integrate it ICT is something separate to your teaching and learning then I don't think you will use it because it is another thing you have to find time for. This isn't something else you do, this is another way you do what you are already doing because our curriculum is so crowded a teacher who sees ICT as something separate or something they have to teach kids won't feel comfortable won't find the time and look the bottom line is kids know how to use this technology better than we do anyway so we're not in the role of teaching them to use it but more in the role of getting them to share what they know with us , because they are just so comfortable with it (Rodney).*

What skills do teachers need to successfully integrate ICT into their teaching and learning?

There is increasing evidence that technology can enhance the quality of learning opportunities and outcomes for students but the mere introduction of new technologies into education does not automatically guarantee this will happen. It has become evident through various research projects (Ertmer, 2005; Gray, 2005; Jimoyiannis, 2007; McKenzie, 1999b) that the attitudes, knowledge and skills of the teacher are vitally important. The role of the teacher is an important factor in the effective integration of new technologies into their teaching and learning practices. To enable teachers to successfully integrate new technologies into teaching and learning they need to have confidence and knowledge about how to do this. It is also important they have the understanding and skills for integrating ICTs into their classroom practices.

> *There is a huge range of abilities and motivation of teachers to engage in ICT incorporating the curriculum… I use the computers most of the time in my teaching role – I do not have the Smart board yet, so I use a projector/laptop set up for about 10-15 minutes each lesson. I use the school camera to capture school activities/events so that students can write about them in their Electronic Journal (Brice).*

As teachers developed their skills and confidence in the use of new technologies they were able to make judgements about when to use ICTs in their classroom practices. This can be seen in the following comments.

My whole approach to teaching has had to change since taking on this role. I did not have 'any' ICT experience before taking on this role in 2006, so I have been on a steep learning curve. I had to really sit back and watch students so as to pick up skills and I also had PD to enhance my core knowledge. Initially, then, I had to learn a lot to be able to teach anything". I have relied a lot more on the use of the Projector/laptop set up and have to move around the room more to make sure that the students are on track. Using ICT is a daily thing and planning for each year level becomes complicated when there are split classes and various abilities within each group (Brice).

The wide range of teaching I provide enables the students to consistently show deeper and more flexible use of technology. There are times when the old ways (eg books, personal interviews) are better suited to a given task (Irene).

As students' progress through the year levels, they will spend more time engaging in collaborative work and participate in more project-based instruction (Rodney).

We still don't know how to scan from our brand new printers and photocopiers so we're on a learning curve which can be frustrating (Alison).

I find that's my biggest thing about ICT is that I can provide real context for kids by having great images up that are real and get kids to connect with what we are talking about and exploring, I can capture what we really do in activity based learning through photographical, digital video evidence and get the kids connected back to that activity when we are reflecting or reviewing so I guess that where it fits into my approach to teaching and learning (Alison).

The children are using technology basically through touch screen more than anything because they are involved in using our whiteboard every day. We are very careful to ensure that every child gets an opportunity to do, we play some of our old fashion games on it like 'What's my number' on the electronic one hundreds chart rather than on one

hanging on the wall. We are using it to do the roll, play games, and practise skills. They're using it to have an opportunity to see things as a whole class and using it for small group work, they write on it a lot because that is really reinforcing that they are writing their spelling words on the electronic whiteboard it's much better than on paper. We use the key board to publish and create documents and we use it for research processes. They use the digital camera to take snapshots. They take a lot of photographs of things that they have created that they will have to destroy or people working on activities or to find things in the school environment that we want to discuss or map out (Irene).

When it comes to developing the capacity of staff many comments were made in regard to the need for professional learning and the time to be able to practice the skills learned.

This has become a somewhat laborious task due to the number of teachers who feel ICT-illiterate and therefore will not try anything out of the ordinary – using Google for research is as advanced as it gets (Rodney).

Wherever possible I share my knowledge and understanding with my colleagues and offer professional learning sessions during lunchtime, afterschool or in their DOTT (Duties Other Than Teaching), some take up the offer but on the whole most don't. I feel it comes down to the individual's attitude and belief about how students learn and their own comfort level (Jan).

What support structures are required to encourage teachers to make pedagogical changes?

With the introduction of ICTs in education teachers reported changes in their teaching pedagogy and their role in the classroom.

In my opinion the following will need to change to enable me to use ICT more effectively in my teaching and learning…more computers… $$ money from government to pay for cabling services and electrical supply which cannot cope in our old run down school…rooms large enough to have computers and 32 kids with desks (Irene).

A robust reliable network is a complete must to ensure staff who are just embarking on the technological journey can be kept on side otherwise they become disillusioned and give up (Rodney).

I am somewhat left up to my own devices in the lab, but whatever PD or support I require is made available to me, on request (Brice).

I can't believe the 'narrow sightedness' of EDWA in this area. 100 Schools, of which we are a Phase 2 school, should have been state wide. The implementation of computers in all schools should have been a priority – LOTE is not of worldwide/real world use (unless they go and live in that country) and computers are the future in Education. A lot more time and effort should be put into enabling students to access a computer every day for at least 40 mins (Brice).

In my approach to teaching I don't know if it's changed my pedagogy a lot but it has certainly improved the way that I can reach kids and engage them. I guess it's improved the way in which I can report to parents because I can photograph the activity based things that we have done (Alison).

I would like to see more use of the networking facilities that we have on our computers so that the children can actually go and retrieve photos for themselves (Irene).

Throughout this study, the issue that was continually identified as a barrier to the integration of ICT was the lack of technical support. This is a big issue in the effective implementation of new technologies into teaching and learning as many of the participants made comments about the lack of technical support available and the underlying pressure it caused

Technical support bit isn't in our school as we are a primary school, so has been really frustrating for us because we have to wait for the technician to come back and if its broken its broken or if it's not working you are really not encouraged to touch it and fix it yourself because we have warranty issues so you have got to wait for the technician come and I know he said he would be here Thursday but now this school has lost its Admin server so he won't actually be back for two weeks so you have got a two week delay. Those kinds of issues can really be

frustrating and it really does put pressure on the deputy principal because he has become a lay technician (Brice).

We had a technician come in once a fortnight to sort out any major glitches in the beginning and as this became too expensive the majority of the trouble shooting was left to the ICT coordinator and the technician was only called in for packaging software or major trouble shooting. It became very frustrating when things didn't work, however things did improve once a new server was purchased and the system was up and running under the LwICT project. The main issue tended to be around the printers and teachers and student not remembering their logons and passwords (Jan).

Another issue identified was that of time. The lack of time for planning, exploring or just playing with the technology was one of the main barriers to integrating new technologies into teaching and learning. Teachers talked about the time needed to learn new skills, prepare suitable activities and to develop ways to make the implementation seamless and, therefore, an integral part of their classroom pedagogy. Teachers often felt guilty for not having enough time to explore and execute effective applications of ICTs. They felt they were wasting the student's time or being unprofessional because they were not in control.

I would like to have a little more time to explore the more creative programs like paint and some of the photographic editing software but I haven't got there this term but that's my long term plan (Irene).

I need more time to play, that's one of the problems, we don't seem to have enough time to do anything… but the thing with using ICT is if you are going to use something new and innovative you have to be prepared to mess it up, forget, have a bit of a retrain, so you do need time for that… and you can't go and do that in front of the kids as it is wasting their time… although sometimes it is good for the kids to see you problem-solve something, but you can't do it all the time though (Alison).

In some schools resourcing and being able to effectively implement and integrate new technologies into their teaching and learning practices were identified as issues. For the successful integration of ICT, teachers do need to have adequate resources at their figure tips.

I think that the ICT that I have got at my fingertips now is really adequate for my teaching needs. I went from a school where I had a lot of ICT resources – like electronic whiteboards and digital cameras three years ago to a school last year where there was one projector in the school; you had to move furniture to be able to be able to put it together. I couldn't print anything within 50 metres of my classroom so if you wanted to print something I had to get someone to come and watch my class or I had to send children unsupervised to another part of the school I found that really difficult. So at the moment I have just got a dream situation where I've got the technology I've got – I don't have a digital camera but I do have my own so I get around that. Everything that I hope that I would be able to do I can do. I actually dropped off using projector screens in my classroom as it was all too hard and too time consuming and really frustrating and if I could not set the classroom up for the lesson before or after a break it was too much time lost in class time to manage it… so I don't have those problems now either (Alison).

As a past ICT coordinator I can have some influence on the teaching of ICT in the school, however I find it frustrating to implement ideas when the budget and time allocation is not given and there is a conflicting view held by leadership of the school and they do not have a clear vision of how and where the school should be going. I strongly believe that the integration of technology into the curriculum is vital to the future educational direction of our students, but many of my colleagues and parts of the leadership team feel that we need to concentrate more on preparing students for the NAPLAN test. In many respects technology integration is not considered important and therefore not given time during PL days or made an integral part of the school's plan (Jan).

Overall the technologies resources for the school are very good thanks to the involvement with the LwICT program and generous support of the P&C in purchasing IWBs, however there need to be more support to create time for teachers to collaborate no only about using technology by planning quality learning programs that will engage and motivate students. The leadership team needs to work with staff to develop a vision and invest in developing the expertise of staff (Rodney).

What school cultures are most supportive of pedagogical change?

The creation of a school culture which enhances learning requires an environment that is supportive of teachers' professional learning, where dialogue between teachers is encouraged and where teachers can come together to support each other. For the school culture to be effective it does not focus on the individual but attempts to help all staff within the school to work together as part of the school community. The leadership within the school fosters a culture of helping individuals come to terms with the constant and rapid changes in technology and encourages teachers to accept and embrace these changes by becoming independent and confident users of new technologies.

> *I am very grateful to be given the opportunity to learn because I don't really believe that I could do too much now without using new technologies. It is such an integral part of the way I teach and the way I accumulate resources and acquire really interesting things for the kids to look at and participate in (Alison).*

> *I think that my approach to teaching and learning has been very different to some of the teachers in schools that I have worked and often my job has been to support teachers in developing skills so that they can use some of the strategies I have been learning to use. I had seen other teachers who were comfortable with ICT using and share those strategies (Brice).*

> *I believe the kids should lead a lot of our learning ICT is a really good avenue as often they're the ones with the better skills in the classroom or I can say to the kids I would like to create a team of ICT buddies and who would like to be part of that team and those children lead or tutor kids in the class while I am doing other things. So I am not often teaching them how to use the technology but they are teaching each other (Irene).*

> *This school is absolutely dedicated to teachers using these whiteboards and we have had training, there is an expectation that we will use it however we haven't got to the point where we can share and collaborate very much (Alison).*

Teaching ICT… it is mainly a collaborative roll in this schools as people skills are very high and are all learning to use this equipment at about the same time, we're sharing a lot of really good websites even to the point where our school registrar will flick through a good website she might have found… it's very collaborative (Rodney).

*The schools' vision for ICT isn't set yet we are still getting the equipment up and running. I do know there is an expectation that we all will be using it regularly and talking to each other about how we are using it and that is happening, but that is the role of one of the role of one of the Deputy principal's and he is still trying to find his feet with it (*Brice*).*

The way that I can improve my classroom practices is that I can see great examples of other peoples work. Teachers have now got use to just carrying USB around with them and we share a lot… and if I see what other good teachers are doing it just reinvigorates me or someone will have a really simple strategy that I would never had thought to use which is much better than the clod hoper I have been dragging out and wrestling with (Alison.

I don't share my pedagogy a lot about ICT I because it is just linked to what I am doing in my classroom learning. However, I share my resources and great websites and my teaching and learning resource. I share a lot with colleagues and they share with me through talking about it, USB exchange or emailing here is another great website related to that theme you are doing and someone will flick a website across (Irene).

What implications does teacher attitude play in successful implementation of ICT into teaching and learning?

Pedagogy embodies knowledge and skills, classroom management and overall effective teaching practices. It is a complex blend of professional knowledge and practitioner skills. A teacher's own pedagogical beliefs and values play an important part in shaping technology mediated learning opportunities.

I guess the thing that has changed my pedagogy through ICT is that because the children are often as good or better than me a using it and it has enabled me to really step up and change my views and attitude about

the children leading the learning and having-not having to be the font of all wisdom, which it was when I went through as a student myself. The teacher was the only one who had the wisdom (Irene).

I integrate ICT into my pedagogy by weaving it throughout everything we do and I am very lucky in that I have an ECU intern who is very computer literate so she is using it and we also use it a lot as an inclusion tool I have been doing this for a long time which is really important for the children who aren't able write very well but perhaps can make a little video grab (Alison).

We have a child in our class with Autism and he can only interact and relate to the learning activities and get some benefit to a point and then there is a point where he disengages. So we will often have something set up that is completely related to the task but it may be a game based on the activity or an interactive digital video program where he has to click and drag to make things go together for example a food pyramid. While the children are off engaged in an instructional strategy where they might be doing something that isn't appropriate for him, he is still engaging in similar learning and getting the same concepts but he would be doing it in a very different way that is engaging for him. It also gives him a break from having to interact with lots of people and that's difficult to him so that's been a good use of it as well (Jan).

The positive aspects and impacts are that you could really capture the essence of what you are doing and engage the kids and hook the kids in. They love the interacting with the digital world, they are such great visual strategies that you can use. However, the negatives are that when it doesn't work it is a real mess and annoying and frustrating. I end up feeling that sometimes I am not as professional as I would like to be in presenting to the kids because this thing isn't working and I have tried everything and I have lost my teaching time. In the end you have got to go back to something else but in the process you have kind of stood there in front of the class fumbling and bumbling and not as professional as I would like to be in front of the kids so that's probably my major negative impact (Alison).

Some teachers felt ICT had not changed their pedagogy as they have always taught interactivity rather it has made it better.

"I sometimes have to be careful to make sure that there is enough concrete stuff going on as while it is wonderful being interactive with the computer program or the computer screen and you can do wonderful things particularly with mathematics activities. I am all for ensuring that they're also physically doing work as much as they can and just scanning and keeping an eye on those kids who'll gravitate in a rotational activity towards a computer base and not getting enough practise with the hands on concrete as I have a really strong belief that children especially junior primary children but children at the lower end of the developmental continua still need concrete stuff to touch even if it is visually very clear they actually have that kind of kinaesthetic moment of touching just keeping that balance I suppose (Alison).

One teacher had a very open mind about the role of ICT in education and a very positive outlook regarding the future direction.

> *I think that by the time our children are working which is probably another ten years there will be very few occupations left in our society which doesn't require confidence with the computer, keyboard skills I think the computers are getting more and more user friendly all the time and that our interfacing with computers is getting more and more user friendly, but I think children who have no fear of using computers and have a real comfortableness will be able to take new innovations in technology that we can't even begin to imagine yet in their stride they won't fumble with it the way we have, it will come second nature and they will have some generalisations that they can apply and that initially for us very new piece of technology was a brand new learning experience, whereas now I think a lot of us can generalise and take skills from that piece of equipment to this piece of equipment and I think the children need to have same sort of flexibility probably more so because they are going to see more change again than us. I think to use it to support learning and thinking teaching computer skills in isolation has no value to me because what we are trying to teach our children to be are thinkers and problem solvers for the next millennium or for the rest of this millennium and we need them to see that being able to use computers as a tool to help them problem solve then be able to use a program such as excel and know that it is a useful tool to be able to do that kind of data analysis or graphing or being able to do a good search on a particular problem and find sources of information and give them informed decisions those kinds of skills are the way we need to be getting*

the children to use computers so that when their adults they have got a whole range of using ICT to give them skills to make informed decisions, to problem solve and be critical thinkers because the whole thing behind our jobs is we don't know what our kids will be faced or doing for jobs in twenty years' time, so we have to teach them to be flexible enough to learn new skills, acquire new skills, think independently and the use of ICT is part of the whole package (Irene).

Some teachers spoke about how ICT was an integral part of their teaching and learning

I don't plan an ICT program… I plan a learning program that involves ICT, I guess I do to a certain extent look at the K -10 syllabus with regard to the technology strand and I do just see what is a bare minimum requirement for a child of this age, but my experience has shown that most kids leave that for dead. I think that syllabus was written probably too long ago now even though it is very recent the skills of the children we are talking about have surpassed our expectations (Alison).

The use of ICT has enabled me to create a more authentic learning environment and if I can't find a real context in my classroom I can make one up and it is much easier with ICT. Often the resources that I would need for something are already there and I am not spending loads of time creating something. I can just pull it off, print it or modified it slightly… so it can be very time saving for me but I find I need a lot of time peruse and find those things first so I can find them quickly so that's the flip side…but once you have got them you have got them and don't have to keep doing them over and over again. Everything I do for planning and assessment are all digital and often it has a lot of pictorial elements and that's wonderful because even if I change the things that I plan as I often do I have a scaffold or a template that I can modify… so I am not starting from scratch and I have not got to the point that I think directly into my computer, I don't do drafts on paper very often now… and I find that is very, very fluid for me and I can get a lot of my work done directly into the keyboard (Irene).

From the data gathered there is clear indication that teacher attitude plays an important part in the implementation of any program and ICTs are no different.

What role does leadership play?

Active and public support by school leaders is crucial for teachers to develop their own leadership roles within the school. This was evident from the following comments.

> *Our Principal and ICT coordinator has (have) worked incredibly hard at fundraising to cable the school appropriately with very little funding from the government. Principal (name removed) has frequently raised over $25000 to get our school up to a very high level of ICT use implemented by our coordinator (name removed) (Irene).*

> *The leadership team encourages staff to plan for ICT integration in learning areas. However, the uptake varies amongst staff and collaborative teams (Jan).*

> *The leadership team is fully aware of how ICT can benefit pupil's achievement outcomes (Alison).*

> *Our school has developed a team approach and have developed a sustainable team (Rodney).*

> *As far as the leadership team goes, they are (rightly)happy with what I achieve and are only ever involved when there is a directive 'from above' or they find something I might like to implement (Brice).*

> *I had absolutely no idea and I was very lucky that I had a very understanding principal who encouraged me in my DOTT time and before and after school to get on the computer and get on the net and find the things that I loved and I develop a really strong connection with the computer. That was great advice and I went on from there and as I got more and more confident I found I could use them as a labour saving device initially for me and then be able to start playing with the use digital cameras and bring the classroom alive with what we were doing and using kids real experiences (Alison).*

I feel the leadership team is not necessary with the implementation of ICT in my classroom but certainly in supporting staff in using it, the expectation that we will use it needs to be there at admin level and time for training. I think the admin needs to make sure they are sending a clear message, which is ICT is important and we want you to use it, but the other part of the message is that it is so important that we are giving you time to learning how to use it (Brice).

I have every confidence in the admin team at my school that they will support us in developing best practice because we have worked very hard in developing the skills working towards best practice as part of our own professionalism (Irene).

Without the support of the leadership team it is difficult to achieve the results you want, to be able to integrate ICT effectively into the curriculum you need to be able to have access to quality programs and implement it in pedagogically meaningful ways. To do this means getting the appropriate professional learning, this takes time and money (Alison).

From the comments presented it is interesting to note the role of leadership and how critical it is if ICTs are to be used effectively in teaching and learning.

What role does professional learning play?

Increasing teachers' confidence and motivation to use technologies is vitally important. Effective professional learning enables the teacher to engage in creative and innovative ICT integration activities in the classroom. Effective professional learning diversifies teachers' ideas and knowledge about how they might integrate technology into their teaching and learning. Good professional learning enhances teacher professionalism and enriches the teaching and learning culture of a school, which in turn provides quality learning opportunities for students. It can encourage reflection, professional dialogue and collaboration practices thereby prompting teachers to link theory to practice.

I have no compelling reason for improving my knowledge/skills of what is already available to use in schools, as I have enough 'weaponry' for the moment. However, I want to be kept 'up to speed' with new developments:/ programs/software/hardware. I have been PL in PowerPoint, Publisher, Digital Learning (Photography), Online Teaching and Learning Systems, Electronic Portfolios, Computer Reporting, 3D Animation, Caravan Animation, and Computers in Schools Learning Journeys (EDWA Versions) (Brice).

I was very fortunate that I was selected to become a 100 schools coordinator so I had 2 or was it 3 years ICT professional learning on a whole range of strategies and amazing resources. Some of those resources are completely obsolete now unfortunately but the strategies are still really good. I got to network and collaborate with hundreds of teachers through that professional learning and that's where I got to learn a lot by talking and seeing what they do with ICT and how they use it. I have also participated in basic program things like Clicker 5 for children with special needs and programs like Word, Excel, and more recently how to use the interactive whiteboard (Alison).

I could not do the job I am doing now without finding a way of being comfortable with new technologies and now that I am comfortable I will try new things and master it until I get it right rather than just not utilising the resource at all (Jan).

At the school level unless you are selected to be part of a Department project there is very little support for developing your individual ICT skills. In most cases, if you want to develop your skills, knowledge and understandings of how to effectively use new technologies in your teaching and learning, you either access the PL yourself in your own time or tap into the PL offered on the DET portal. As I think technology is important and has a place in education. I go out and seek my own professional learning. opportunities, be they conferences, online learning, doing extra study and research or just 'playing around' at home trialling different programs (Irene).

4.20 Summary of Findings

The analysis of the questionnaires, interviews and observations helped to provide some answers to these research questions. The participants were integrating and or using new technologies in different ways to enhance their teaching and learning.

From the data collected in this study the researcher feels the pedagogical stance of those interviewed was clearly evident. The participants' attitudes towards teaching and learning with ICT in primary schools were considerably varied, especially in their need of being in control rather than handing this responsibility to the students. From all the data gathered teachers did not feel teaching and learning with ICT had changed their pedagogical approach rather, in some cases, it gave them greater flexibility to enhance their current practices.

It can be noted from the data gathered that, although teachers show a great interest in and motivation to learn about ICT their use of ICT tools is limited and focused on a narrow range of applications - mainly being for personal use. Most of the teachers continue to use new technologie**s,** especially computer**s,** for low level supplementary tasks such as word processing and internet searches. Relatively few teachers usually use ICT for instructional purposes and even fewer are making new technology an integral part of their teaching and learning across all learning areas. More importantly, even fewer are teaching in a way that motivates students, enriches learning opportunities and stimulates higher order thinking and reasoning.

To assist in the analysis of data collected in this study**,** the personal journeys and interviews were scanned for common themes in relation to the research questions. The themes that were common throughout the questionnaires, interviews and observations have been identified and presented in Table 56. From this study, it is evident there are many complex issues related to the effective and successful integration of new technologies into teaching and learning.

Table 56

Research questions and emerging themes

Research Questions	Emerging themes
Why use ICT in primary schools?	Motivation Engagement Independent learning -Transformative Vision Leadership
What is the pedagogical justification for investing in ICT in primary school?	Open ended learning Individual Problem solving Student focuses Interactive knowledge environment Strategic planning
What new skills do teachers need in order to empower them to integrate ICT effectively into the classroom?	Competent Collaborative Effective planning Engage, share, connect and lead Networking Lifelong learning Digital literacy
What support structures are required to encourage teachers to make pedagogical change for the successful integration of ICT?	Leadership Access to equipment Professional learning Shared vision ICT management – budget, plan, technical support
What school cultures are most supportive of pedagogical change for successful implementation?	Supportive Encouraging Open Collaborative Transforming learning Partnerships
What implications does teacher attitude play in successful implementing ICT?	Positive Flexible Open to new ideas Identify a need
What role does leadership , teacher attitude and professional learning play in the successful integration of ICT	Supportive Mentoring Peer learning, hands on support

Table 57 gives an overview of the elements needed in the developmental process and the stages people go through in implementing ICT into their teaching and learning.

Table 57

ICT development process

Dimensions of ICT use	Stages of ICT development	Description
ICT as a tool for use across the curriculum or in separate subjects where the emphasis is on the development of ICT related **skills, knowledge, processes and attitudes.**	**Minimum - Emergent**	In this initial phase, administrators and teachers are just starting to explore the possibilities and consequences of using ICT for school management and adding ICT to the curriculum. Schools at this emerging phase are still firmly grounded in traditional, teacher-centred practice. The curriculum reflects an increase in basic skills but there is an awareness of the uses of ICT.
ICT as a tool for learning to enhance students' learning outcomes with the existing curriculum and existing learning processes.	**Developmental-Applying**	Schools adapt the curriculum in order to increase the use of ICT in various subject areas with specific tools and software. Teachers largely dominate the learning environment.
ICT as an integral component of broader curricular reforms that change not only how students learn but what they learn	**Innovator -Infusing**	Involves integrating or embedding ICT across the curriculum, and is seen in those schools that now employ a range of computer-based technologies in laboratories, classrooms, and administrative offices. Teachers explore new ways in which ICT changes their personal productivity and professional practice. The curriculum begins to merge subject areas to reflect real-world applications.
ICT as an integral component of the reforms that alter the organisation and structure of schooling itself.	**Leader - Transforming**	Schools use ICT to rethink and renew school organization in creative ways. ICT becomes an integral though invisible part of daily personal productivity and professional practice. The focus of the curriculum is now learner-centred and integrates subject areas in real-world applications. ICT is taught as a separate subject at the professional level, and is incorporated into all vocational areas. Schools have become centres of learning for their communities.

A key element in the process of paradigm change and adoption of new ICT learning tools in schools is the *ICT development process.* Research in ICT development identified at least four broad approaches through which educational systems and individual schools proceed in their adoption and use of ICT. The ICT approaches,

described in the Table 57, can be regarded as developmental stages of relating with the new technologies (Khvilon & Patru, 2002)

In this chapter we have looked at the data that identifies elements participants' believe to be critical in ensuring effective and sustainable implementation of new technologies in relation to the research questions. These are discussed below.

4.20.1 Teaching and learning with ICT

In relation to teaching and learning with ICT most teachers identified areas of personal need with an emphasis on the learning of skills to use specific software packages. Few teachers identified the need to have instruction and support on how to use new technologies effectively in their teaching and learning. This may reflect the notion that teachers are still struggling to develop basic ICT skills. However, it may also reflect the teachers' difficulty in changing pedagogy generally and integrating new technologies specifically.

> *I really like to engage kids in active learning, cooperative learning strategies… I like creating a real context for learning or taking as many real contexts in the daily running of the class so that they become really good teaching opportunities things that arise naturally (Rubin, .Graduate teacher, L4 metropolitan school)*

4.20.2 Pedagogical justification

While many of the participants were more concerned about having access to more computers and professional learning one participant stated:

> *I am very lucky to be part of a school that adopts ICT as a priority that goes hand-in-hand with Inquiry Based learning (Elyse, teacher L5 country school).*

While Rachael, a teacher in a level 5 metropolitan school stated…

> *Use of computers has allowed for greater student enthusiasm… guided use if the internet has started to bring a greater world view to my students (this is especially true when I worked in a remote community).*

4.20.3 Empowering teachers

Due to time constrains and access there was very limited opportunity for teachers to engage in a sustained dialogue about their ICT use. This appeared to be a significant limiting factor into effective teaching and learning with ICT, and indeed the enhancement of professional practice generally. Some of the typical comments made by teachers reflected their frustration at not having the time to explore, plan and share their ideas.

> *I need time to learn and plan, time to explore resources…more time for planning and researching websites and other software packages.*

The uptake of teaching and learning with new technologies appears to be strongly correlated to the personal experiences of teachers. Those teachers who have a positive disposition toward technology have learned technology skills/software packages themselves, mostly through exploration and trial and error informally or by tapping into online learning opportunities offed by DoE or external sources.

> *I much prefer PD run by a human as the lack of this typed of PD is stifling my development in this area…I don't like online PD (Glenys, experienced teacher L5 metropolitan school).*

Some schools have made some effort to provide training and or support for teachers at school; however this is often in an ad hoc manner. Participants in the study made the following comments when asked what factors need to change to enable you to use ICT in your classroom:

> *I would like to become more confident through further PD and support from ICT coordinator (Karris, beginning teacher L3 rural school).*

> *PD… PD… PD and more PD…PD on programmes and software not just 'put on the shared drive and expected to use it… I want lessons modelled… I need help in the classroom (Marie, teacher L5 metropolitan school).*

Ongoing PD the students usually know more than we do… (Renae, teacher L5 metropolitan school)

Continual PD to keep teachers up to date with technology (Georgia, teacher L6 metropolitan school

I am keen to incorporate more but feel frustrated by the lack of resources (Ronnie, teacher L5 country school).

Whilst one leader commented:

We have an ICT coordinator but unfortunately they take the class which is a waste of time as the teacher never attends and nothing is learned… it is better to have the ICT teacher as support especially if the ICT topic is related to the requirements of each classroom teacher (Pauline, Principal L5 metropolitan school).

4.20.4 Support structures

Maintenance is an ongoing issue for most schools and many rely on the good will of one or two staff members to fix any technical issues that may arise. As these staff members do not normally get extra time allocated to this task, there are often delays in fixing such problems. Comments that reflect this concern are:

The Government/Department needs to provide technical assistance to schools from professional and not expect teachers to take on the impossible task of maintaining the network (Michael, ICT coordinator, L4 outer metropolitan school).

I would love to see a computer technician (with a specialist understanding of school needs) to be attached to a few schools and be available weekly to ensure that the technical aspects of the network run smoothly… furthermore the salary should be paid for by DET and not the schools (Nathan, teacher L4 metropolitan school)

We need more on-site technical support. It is a stress when something doesn't work and that's when people give up (Paul, Deputy Principal, L5 country school).

…in my school funding is an issue. I would like to be able to use more ICT in class but hardware/software infrastructure needs upgrading Francine, teacher L 4 country school).

One area of ICT that causes problems is that of technical support. We budget for it but only so much can be allocated in the meagre budget our school is given. Most ICT problems in schools are handled by teachers who have picked up some necessary skills, but overall when major problems develop these aren't adequate. The department needs to allocate a tech support person to school clusters (John, Principal L5 metropolitan school).

On the positive side some leaders have reported that:

Having the staff supported through the LwICT project has been very effective…it has allowed us to work as a team and develop sustainable practices and experts across the school (Julie, Principal L4 country school).

4.20.5 School culture

Integrating new technologies into teaching and learning poses numerous challenges for schools. Some of these difficulties can be overcome by attending to the external barriers such as access to technology. However, the less tangible or intrinsic barriers such as teacher attitude and collaborative culture that supports sustained professional dialogue and opportunities for professional learning are more difficult to overcome.

After school "Cyber Cafes" died during the Industrial action (Dorothy, Principal L4 country school)

Nevertheless there are or there is a small percentage of schools which schools are working around these issues and making a difference. Some of the typical comments made were:

The school plots teacher development on the ICT Self Evaluation Guide and three staff members help others when necessary. We have implemented a 'lighthouse' class with an Interactive White-board and we plan to have teachers share with this teacher (Jan, Associate Principal L5 metropolitan school).

…designate two teachers to provide support with planning…linking to curriculum and delivery. This includes in class support at the time of the ICT rich lesson (Gary, Principal L4 metropolitan school).

…teachers receive individual support and work with a buddy teacher or class (Michael, ICT coordinator L4 country school).

…both the Deputy and Level 3 teacher take time to work 1-1 in small or large groups to up-skill teachers. The level 3 teacher also goes into the class and team teaches with teacher using ICT (Glenn, Principal L4 country school).

4. 20.6 Attitude and Belief

In 2005 the Evaluation and Accountability section of DET conducted a similar survey to this study and reported in their findings that, on the whole, teachers' attitude toward ICT was extremely positive. The findings of this study were also positive to the use of technology in teaching and learning, with some of the typical responses made by participants being:

I believe the integration of ICT is extremely important, however students still need to be taught skills and that not all information found on the web is true, that copying and pasting of images and text without acknowledging the author is a breach of copyright and plagiarism can have serious consequences (Miranda, teacher L5 country school).

I'm keen to incorporate more but feel frustrated by the lack of resources (Ronnie, teacher L5 country school).

Whilst one participant wanted to integrate technology into his/her classroom activities he/she felt frustrated and restricted by 'red-tape':

> *I job-share with another teacher so I do not have the range to integrate ICT like I would like to (in fact I am entitled to one period of 70 minutes per week in the lab and I am not allow to load things into our class computers) (Nancy, teacher L5 metropolitan school).*

The potential of computers to support learning has been shown through the literature review process to be varied and expanding; however this research also showed for most students the impact has been negligible. These results are similar to the finding of other researcher's such as Newhouse, (2010), and DET (2005).

Why use computers in primary classrooms?

Many participants felt that they did not have access to enough computers therefore found it frustrating and pointless to even try to integrate new technology into their teaching and learning. The following comments were typical of the responses given:

> *It is virtually impossible for me to use technology (computers) in my classroom as I have each class for 45 minutes and only two computers (Miranda, teacher L5 country school).*

> *At present the rhetoric of ICT outweighs the reality. Teachers tend to do computers rather than integrate ICT. We all need to be convinced that ICT will enhance learning (Bill, teacher L4 metropolitan school).*

> *I believe the integration of ICT is extremely important however students still need to be taught skills… before you can teach ICT there are some fundamentals which must be taught (Miranda, teacher L5 country school).*
>
> *…too much personal time spent learning software and searching for 'good sites'. Ed Dept provides 1700 online resources. Great I'll look at them soon! (Suzanne, teacher L5 metropolitan school)*

However, not all responses were doom and gloom. Some participants were enthusiastic and made the following comments:

I use new technologies to improve my teaching and learning by including it every day in all lessons and not by teaching stand-alone ICT skills. ICT should be a tool for learning, for encouraging and motivating students to learn (Michael, teacher L4 outer metropolitan school).

…use it as a tool for teaching and learning rather than in isolation – making tasks relevant and meaningful that utilise ICT software and hardware (Roger, teacher L5. metropolitan school)

…use it as often as I can in as many different ways as possible… technology is simply another tool in my classroom so that the students observe me using it all and they too are constantly involved in the technology as opposed to ding technology or doing computers (Marlene, teacher L4 metropolitan school).

…as a tool used by students across learning areas to cater for individual needs. I use it to introduce, develop consolidate and revise aspects of the learning program at a whole class, group and individual level (Alison, teacher L5 country school).

4.20.7 Leadership

For new technologies to be effectively integrated into teaching and learning requires the support and guidance of the leadership team:

Without the support of the leadership team it is difficult to achieve the results you want, to be able to integrate ICT effectively into the curriculum you need to be able to have access to quality programs and implement it in pedagogically meaningful ways (Raelene, teacher L5 metropolitan school).

I was very lucky that I had a very understanding principal who encouraged me in my DOTT time and before and after school to get on the computer and get on the net and find the things that I loved like my gardening or my interest in environmental issues and peruse and develop a really strong connection with the computer. That was great advice and I went on from there and as I got more and more confident (Alison, teacher L5 country school).

> *School leaders really need to have good vision and conceptual understanding of what makes an ICT rich school and know where to seek advice if they are not sure…it does not mean that they have to be technical wizards Troy, Principal L4 rural school).*

It is interesting to note from the data gathered throughout this study that both teachers and leaders identified the following elements to be critical in ensuring ICT is an integral part of teaching and learning. These elements are:

- Clear vision
- Supportive leadership
- Effective and timely PL
- A shift in pedagogy, attitudes and beliefs about how students learn
- Time to explore and adapt
- Confidence and motivation to change the way things are done.

Despite the increasing presence of new technologies in schools and the countless professional learning opportunities for teachers to acquire basic skills, teaching and learning with ICT is a far cry from reality. Many teachers use new technologies only as an additional add on to regular instruction or as a reward for early finishers. In sum, in many cases the teacher uses technology to extend traditional pedagogical practices (Schiller, 2003).

In summary it is suggested that if educators are going to make the most of ICTs in classrooms and fundamentally change the way people learn, communicate and do business then there needs to be a paradigm shift.

The next chapter is the discussion chapter. It will provide an analysis of the material presented in the preceding chapters with the aim of systematically addressing the research questions presented in Chapter 3.

CHAPTER 5

DISCUSSION

5.1 Introduction

The previous chapter presented the data from the questionnaires, interviews, observations and informal discussions. Data for this research was collected from 2008 – 2010. This chapter provides a discussion of the analysis of the data presented in the preceding chapter. .It presents the findings from this research supported by research described in the literature review and will systematically address each of the research questions using a novel model for analysis from policing. This will be explained in this chapter.

All names referred to in this discussion chapter are pseudonyms to protect the identity of participants and ensure their privacy.

The research questions, posed at the end of chapter 1, have an organisational framework based on the crash investigation model, described in detail in chapter 1, for investigating the research questions in this research. This section shows how the findings have extended previous research in the area of teaching and learning with ICT in primary schools and provided a new and current set of outcomes for progressing the embedding and use of technology use in Primary school classrooms in Western Australia.

To guide research and the discussion in this study, a conceptual framework based on the Crash Investigation Model (see p. 19).has been utilised as a means of clarifying the complex interactions that are present in the data, and in the classroom participating in this study. This framework looks at three aspects:

- the environment (School/system – school ICT capacity, PL, school planning and leadership)
- driver (teacher/leadership – Demographics, ICT skills and knowledge, teacher attitudes)

- vehicle (application – assessing student outcomes, teaching and learning programs and professional use)

For this discussion these aspects will each have research questions that are relevant to then present in a systematic way. So, for the first section, the environment means the system and or school. The research questions which will be discussed under this section are:

- Question 1: Why use ICT in primary school classrooms?
- Question 2: What is the pedagogical justification for investing in ICT in primary school?
- Question 3: What support structures are required to encourage teachers to make pedagogical changes for the successful implementation of ICT in the primary school classroom?
- Question 4: What school cultures are most supportive of pedagogical change for the successful integration of ICT in the primary school?

Following on from this, the second aspect examines the Driver element. In this research the driver is classified as the teacher and or leader within the school. The research questions to be discussed in this section are:

- Question 5: What implications does teacher attitude play in the successful integration of ICT in the primary school classroom?
- Question 6: What role does leadership play in the successful integration of ICT in the primary school?

The final aspect to be discussed is the Vehicle element. In this research this relates to the application of ICT and the following research questions will be discussed in this section:

- Question 7: What skills do teachers need in order to empower them to integrate ICT effectively in the primary school classroom?

- Question 8: What role does professional learning play in the successful integration of ICT in the primary school classroom?

5.2. Why use ICT in Primary School?

This is a key question for any school, especially as there are sometimes cheaper options for learning and teaching. To investigate support for this research question the literature and government policies examining technology integration and use in everyday life were examined. A vast majority of the evidence suggests that skill in the use of technology is highly regarded as an essential skill for students and citizens of the 21st Century and beyond. Even though researchers have concluded technology can improve the quality of teaching and learning opportunities and enhance the learning outcomes for students in reality the situation in schools is generally very different (DETWA, 2004; Mishra & Koehler, 2006; ISTE, 2007; DER, 2008; Lee & Winzenried, 2009; Lee, 2011). Research has indicated the adoption and uptake of technology into teaching and learning has been slow if not stagnated (Fluck, 2003; Ward & Parr, 2011). Eisenberg & Johnson (2002) found in their study, too many schools, teachers and students still use computers only as the equivalent of expensive flash cards, electronic worksheets, or little more than a typewriter. The productivity side of computer use in general teaching and learning is neglected or grossly underdeveloped. Therefore, education is failing students in their development and learning to be active and life-long learners into the future (Eisenberg & Johnson, 2002; Bates, 2010; Ward & Parr, 2011). With this in mind, it is the position of this study that it is important to adopt new technologies as part of the teaching and learning pedagogy. So why use ICT in primary schools? Meadows and Leask (2000) sum it up nicely when they state "learning with ICT in the primary school helps develop in children the sorts of transferable skills, such as problem solving and communication, which will be useful to them in the future" (p. 1). Furthermore, Bates (2010) suggests "the integration of ICT classroom practice can incorporate a broad range of activities from those designed to encourage students to consume knowledge to those designed to develop students' abilities to produce their own knowledge" (p. 1042).

The data from this study would suggest even though participants in this study support the need for technology skill development in theory, the reality is somewhat different when teaching practice and pedagogy are examined. This study found:

- the majority of teachers only occasionally use ICT and often under a sense of obligation rather than a declaration of its value as an educational tool;
- in most schools students use ICT for minimum of time at school, in most cases no more than one hour per week. When students had access to technology, in this case computers, it was mainly used for accessing and presenting information with little thought to application, analysis and syntheses;
- most students' ICT skills are narrow and usually determined by what they do at home or the capabilities of their teacher;
- most ICT use is ad hoc and peripheral to the main learning.

Participants in this study identified ICT as a motivation for students to learn. They indicated students tended to be more motivated and engaged with their learning when involved with the application of ICT. Furthermore, the school leadership who participated in this study indicated in their interview data that they believed that using ICT in primary school is important for meeting students' need**s,** that it reduces barriers to learning for individuals and builds self-esteem and independence.

Some teachers and leaders in this study made the following comments when asked why we should use ICT in primary schools. These were representative of the views held by teachers in the schools.

Mary-Ann, a teacher in a level 5 rural school, stated…

> *As a teacher with more than 20 years' experience I have seen many changes and amazing advances in technology available in Education recently. I agree that many of these learning experiences can be achieved using pencil and paper but what you find in education is that these new tools are there so why not use them and teach students how to use them.*

While Michael, an ICT coordinator in a level 5 outer metropolitan school, said…

> *They are becoming necessary tools in the work place and education should be leaders and not many years behind as often happens.*

Simon, a level 4 Principal, reflected…

> *New technologies offer a variety of ways to differentiate for students in the classroom and meaningful ways to engage students who are not motivated to engage in learning.*

And Sharon, a teacher in a metropolitan school, said…

> *Many students have access to these technologies at home and can become frustrated if not given the option to use them at school.*

Furthermore David, an Associate Principal in an outer metropolitan school, remarked…

> *Technology provides opportunities for students to be very creative and innovative. Education today should not be so much about learning skills but learning how to learn. Technology provides the avenue to do this.*

Whilst Sheryl, a teacher with more than 20 year experience, commented…

> *In this fast changing world this is how education must change to keep up with these amazing changes which happen so quickly. Teaching skills become so out of date so quickly that those skills can become redundant.*

When participants were asked why they thought teachers did not integrate technologies into the teaching and learning pedagogy. Some of the teacher participants stated:

> *Most of the staff reluctant to integrate ICT into their teaching and learning, did not have them as a teaching tool some 20 years ago and therefore, feel 'dumb' in doing it (Tania, teacher L6 metropolitan school). They don't know what they are doing and feel really inadequate about using it (Pauline, teacher from rural WA). Some find it hard to let go because for so long they have been the person*

with the knowledge and find themselves in an embarrassing situation of not knowing what to do (Jan, teacher - L3 metropolitan school).

Whilst others reflected by saying;

I guess some of them have not seen how powerful it can be in the classroom or they see it as another thing they have to teach rather than as a resource for helping and enhancing what they are doing (Reece, Principal - L5 country school).

The following statements from the questionnaires and interviews were used to elicit responses about the place of ICT in teaching and learning: The findings from the questionnaire indicated mixed responses in regard to the statement 'ICT has no place in primary school' with 87% of the respondents either strongly disagree or disagree that**.** However, 51% either agree or strongly agree 'ICT is time consuming or presents teachers with difficulties'. While 59% strongly disagree or disagree ICT has limited capacity to provide benefits in the classroom.

It is interesting to note even though many participants believe ICT has a place in primary education and want to integrate technology into their teaching they felt they did not have access to enough computers. Therefore, found it frustrating and pointless to even try to integrate new technology into their teaching and learning. The following comments were typical of the responses given:

1. It is virtually impossible for me to use technology (computers) in my classroom as I have each class for 45 minutes and only two computers (Georgie, teacher – L6 metropolitan school).

2. At present the rhetoric of ICT outweighs the reality. Teachers tend to do computers rather than integrate ICT. We all need to be convinced that ICT will enhance learning (Bill, teacher – metropolitan school).

3. I believe the integration of ICT is extremely important however students still need to be taught skills… before you can teach ICT there are some fundamentals which must be taught (Miranda, teacher – L5 country school).

4. …too much personal time spent learning software and searching for 'good sites'. Ed Dept provides 1700 online resources. Great I'll look at them soon! (Suzanne, teacher - metropolitan school)

However, not all responses were doom and gloom. Some participants were enthusiastic and made the following comments:

1. I use new technologies to improve my teaching and learning by including it every day in all lessons and not by teaching stand-alone ICT skills. ICT should be a tool for learning, for encouraging and motivating students to learn (Shannon, teacher – L4 rural school).

2. …use it as a tool for teaching and learning rather than in isolation – making tasks relevant and meaningful that utilise ICT software and hardware (Elyse, teacher - L5 rural school).

3. …use it as often as I can in as many different ways as possible… technology is simply another tool in my classroom so that the students observe me using it all and they too are constantly involved in the technology as opposed to doing technology or doing computers (Irene, Associate Principal - L5 metropolitan school).

4. …as a tool used by students across learning areas to cater for individual needs. I use it to introduce, develop consolidate and revise aspects of the learning program at a whole class, group and individual level (Janice, teacher - L4 country school).

5.3 Pedagogical Justification for Investing in ICT in Primary Schools

For ICT to get onto the agenda of national policy makers, it had to offer some advantages to education in the form of improved teaching and learning outcomes. Therefore, if educators cannot answer the question, "what is the pedagogical justification for investing in ICT?", by demonstrating enhanced learning outcomes for students, then governments cannot be expected to fund the integration of ICT into teaching and learning (Meadows & Leask, 2000).

The pedagogical justification was difficult to justify with the research evidence presented in the literature indicating ICT has about the same impact as any other

innovation (Fullan, 2011, November, 2010). In this study, however the questionnaires, interview, personal journeys and case study evidence confirm the findings in the literature about ICT increasing learner motivation and engagement. Furthermore, this study supports the notion that there are many reasons for investing in technologies in the primary school such as empowering teachers, support structures for teachers and leaders, teacher attitudes, leadership and school's capacity to support ICT integration.

The integration of ICT into teaching and learning has been one of the great debates in education over the past three decades. Although many attempts have been made over time to integrate ICT into teaching and learning, research evidence has shown technology is not always used as expected (Smerdon et al., 2000; Mishra & Koehler, 2006; Bates, 2010). Research demonstrates the mere availability of technological equipment does not imply successful use and implementation of educational technology into teaching and learning. Typical comments from participants of this study concur by maintaining…

> *At present the rhetoric of ICT outweighs the reality. Teachers tend to do computers rather than integrate ICT. We all need to be convinced that ICT will enhance learning (Bill, teacher - metropolitan school).*

Another participant stated…

> *Bottom line - teachers need to be good at their jobs. If we paid them more we'd probably attract better candidates. Technology as a medium is no substitute for teaching, and as a subject matter it is more demanding than traditional subjects (Robert, teacher - L5 metropolitan school).*

The general consensus is represented by the following:

> *I'm all for technology but it needs to really be relevant. It is too easy to cheat or underperform by using it. I ask my students what the difference is between information and knowledge. They don't know the answer at all (Gaye, teacher - L5 metropolitan school).*

However, one participant held the view that technology has a place in teaching and learning by stating…

> *I improve my teaching and learning by including technology in all lessons not by teaching stand-alone ICT skills. ICT should be a tool for learning, encouraging and motivating students to learn (Shannon, teacher - L4 rural school)*

There are various factors, such as teachers' knowledge, skills and beliefs as well as the culture, the curriculum and the pedagogical approach of schooling, which influence the integration of ICT in education (Vrasidas & Glass, 2005). According to Prensky (2005) students are discriminating consumers and users of technology and are fully aware that teachers are not. What students instinctively realise is they need help and guidance from teachers and educators who are preparing them for their future. The problem is many of these teachers and educators are not living in the present so how can they prepare students for the future when they, themselves are not prepared for the present (Vrasidas & Glass, 2005). The data gathered for this study supports this as indicated by these participants' remarks…

> *This school is not as advanced in integrating ICT into teaching and learning as it should be. The Principal and some staff members are looking at a variety of ways to address/improve this (Rachael, ICT coordinator - metropolitan school).*

> *There is a huge range of ability and motivation of teachers to engage in ICT incorporation in the curriculum. A robust, reliable network is a complete must to ensure staff who are just embarking on the technological journey (revolution) can be kept on side. Otherwise they become disillusioned and give up (Fran, Principal - L4 metropolitan school).*

And with one principal stating…

> *When I came to this school eighteen months ago they had a plan in place but it was based on one particular person's knowledge and skills. Don't get me wrong, he was a fantastic teacher and has put a huge amount of work into our school, but he was of the mind-set of we have these*

computers and all we need to do is upgrade them (Rodney, Principal - L5 metropolitan school).

The findings from the questionnaire conducted in this study indicated 86% of the teachers who participated believe new technologies have a place in primary schools with 79% stating they understand how using ICT can enhance teaching and learning. In the school leadership questionnaire the schools leaders indicated overall they believe using ICT in learning and teaching as very important. They cited factors such as ensuring access and support is available to meet the needs of teachers and students, and appropriate professional learning is available and supported. The leaders stated ICT resourcing was still considered an obstacle and therefore, one of the main reasons teachers are not integrating ICT effectively into their teaching and learning.

5.3.1 Empowering teachers

Effective teachers' take into consideration the different learning styles of students (Cripps-Clark & Walsh, 2002). To ensure all teachers are effective teachers there needs to be a pedagogical shift in how we interact with students and the learning environment on offer. An effective use of ICT in schools can have an immediate positive impact on the schools' learning environment (Cox, et al., 2004). For example, by creating more dynamic interaction between students and teachers, increasing collaboration and team work in problem solving activities, stimulating creativity in both students and teachers and helping students to control and monitor their own learning (OECD, 2001). Furthermore, successful integration of ICT in schools will facilitate students to develop skills useful for the future (OECD, 2001). The findings of this study suggest some participants support this notion by making the following comment…

I am very lucky to be part of a school that adopts ICT as a priority that goes hand in hand with Inquiry Based learning… I will continue to do what I am doing as the results speak for themselves. I will make sure I stay up to date and continue to move the students forward by introducing

new programs to use in conjunction with their learning (Elyse, teacher - L5 rural school).

Technology use versus availability

The difference between the amount of technology readily available to public schools and public school's amount of use of this technology is shockingly different Hollon (2010). With new technology being produced daily, it is daunting for schools to keep up with and to best prepare teachers to survive in the technology integrated classroom. However, the findings in this research indicate most schools have some resources; however these may not be as up to date as one would like.

Many participants expressed the need to have greater access to up-to-date and reliable technology if they were going to effectively integrate it into their teaching and learning. A few typical remarks are presented below…

It is virtually impossible for me to use technology (computers) in my classroom as I have each group for 40-45 minutes and only have two computers. The best use I have made of them is by using science software to assist the learning disabled students (Miranda, teacher - L5 country school).

Increase the number of classroom computers by increasing the number of computers available. Three computers for twenty six children is unrealistic! (Jane, teacher - L5 rural/remote school)

Brice an ICT coordinator from a metropolitan primary school commented…

In my school funding is an issue. I would like to be able to use more ICT in class but hardware/software infrastructure needs upgrading.

Data gathered through Questionnaire A, indicated 78% of the participants had the capacity to integrate ICT into their teaching and learning, however**,** only 58% stated they had used the resources available. This finding supports Hollon's (2010) notion

that there is a difference between availability and use. From the researcher's own experience it was noted in the schools she visited and worked in, that there were ample ICT resources available but in many instances these resources remained unused or at least under-utilised.

Teachers' use of new technologies

This study also shows that many educators believe ICT is recognised as a vital component of classroom practice; however, many teachers have failed to embrace this as a teaching tool (Papert, 1996; McKenzie, 2004; November, 2010; Ward & Parr, 2011).

From this study, the multiple data sets gathered through questionnaires, interviews and classroom observations indicates that the participants of this study mainly use ICT for creating materials or accessing research and not for posting information on the web or accessing online professional learning. In the case of student access, teachers mainly have students do word processing like activities such as typing up stories and internet searches. Regarding their selection of tasks for ICT in teaching some of the comments expressed by the participants were…

> *The Word/Publisher and PowerPoint programs lead to more students writing and writing of a higher quality, while using the Internet, in a guided form, increases access to information and assists in improving research analysis skills (Brice, ICT Coordinator - L5 metropolitan school).*

And Alison, a teacher from a Level 5 country primary school, noted…

> *I plan learning activities in which we will use the computer and then while we are using the computer, I make sure they're learning about font styles, and it's not a separate thing but part of what we are doing, it's integrated and they do love it. I do teach, it's almost like a first draft, on whatever the default setting is and when we have got the first draft sorted, spelling sorted we go back and change the font, colour, the boarders or whatever so they are learning how to make those changes, but the priority is getting our communication right first.*

If teachers are going to improve the teaching and learning outcomes of their students, then they need to engage their students in meaningful and stimulating authentic learning situations. These situations should explore a variety of learning styles, equip students with a tool kit of effective strategies and graphic organisers to enhance problem solving, critical thinking and higher order skills through the use of Bloom's Taxonomy and other skill hierarchies (Bate, 2010; November, 2010; Martinez, 2010).

The use of information communication technologies and the ever increasing array of hardware and software will be the tool to do this (Watson, 2001) but before we change knowledge and how we access it we need to know what knowledge will be needed for the 21st Century (Mishra & Koehler, 2006). Watson advocates "policies should address the nature of learning and teaching to achieve such knowledge". The practices within the current education system do not equip students for the occupations of the 21st Century, many of which have not been invented yet. Veen (1993), for example, found teachers are more likely to adapt new technologies if they can use it in accordance with their existing beliefs and practices. Research suggests teachers with student-centred pedagogical beliefs who adopt a student-centred approach are more successful at integrating technology concepts in classes. Nevertheless, anxiety about computers prevents them from using the technology. In contrast, teachers with traditional beliefs are more likely to face greater challenges integrating technology (Honey & Moeller, 1990). When teachers were asked how they could use new technologies in their classrooms to improve teaching and learning these were some of the typical comments...

> *Continue to do what I'm doing as the results speak for themselves. Make sure I am up to date with latest technology and continue to move students forward by introducing new programs to use (Elyse, teacher - L5 country school).*

With some teachers stating comments such as…

> *I can best improve my teaching and learning by including technology in all lessons not by teaching stand-alone ICT skills. ICT should be a tool for learning for encouraging and motivating students to learn (Shannon teacher - L4 rural school).*

And…

> *Use it as a tool for teaching and learning rather than in isolation making tasks relevant and meaningful that utilises ICT software and hardware (Roger, teacher - L5 metropolitan school).*

In this research 30% of respondents from the questionnaire indicated ICT was having an extensive impact on what students learn and how they learn. While 39% believe ICT is a useful resource impacting on some areas of the curriculum. When asked how they can best use ICT to improve their teaching and student learning these were some of the typical responses.

One teacher commented…

> *Having a Year 1 class has meant I have spent much of first semester teaching the basics for example logging on; mouse and keyboard control and moving around the school intranet… Now they have become more competent I am using ICT more as an integrated part of my program, for example children learning about insects created a PowerPoint™ slide with information researched about their chosen insect. As I become more confident I am integrating it more and more (Karris, beginning, teacher – L3 rural school).*

And another saying…

> *Teacher made PowerPoint™ presentations are my favourite but self-made quizzes and tools like Inspiration™ are a hoot… the kids also love Movie-Maker™ and Swatch™. All these fit into the Inquiry learning tool well (Renae, teacher - L5 metropolitan school).*

While another stated…

> *I am very lucky to be part of a school that adopts ICT as a priority that goes hand in hand with Inquiry Based learning (Elyse, teacher – L5 country school).*

One principal summed it up with…

> *By prioritising the needs of the school and creatively utilising the resources available the school was able to establish a distributed leadership. Time and resources were allocated to release people to do the things needed to ensure the school vision and plan was implemented. To*

be able to give people this time resource to carry out their duties was very powerful. Through careful planning we are able to run professional learning opportunities and this in itself gave teachers a venue, time and place to come and learn whatever they needed to. Each of the sessions was summarised into an A4 folded newsletter. They not only summarised the marvellous things that were being done but they told teachers where they could go next for support and or help. These documents were exciting, refreshing and reinforced the pedagogies that would become whole school pedagogies. Add to this the teachers were very keen to visit what other schools throughout Australia were doing to employ ICT successfully in teaching and learning and as a school we organised educational tours for those teachers interested and began doing the same (Mark, Principal - L5 country school).

Within the limited number of lessons observed and from the interviews undertaken, the researcher feels that even though teachers stated they understood how to integrate new technologies into their teaching and learning they are still doing it superficially. In many classrooms teachers are using technology but mainly computers and, in some cases, IWBs. However, this is not to suggest teachers are always using the technology integration tool in their teaching and learning.

When teachers were asked how they integrated technologies into their teaching and learning these were some of the typical comments…

I mainly use computers for word processing. I create worksheets and letters and I have started using it for keeping personal records (Sue, teacher - L5 metropolitan school).

Or…

I have a computer in my classroom but I find it very limiting for use between so many students. My year 1 class just played educational games before school and I use it for publishing the children's writing (Jane, teacher - L5 rural/remote school).

The teachers who participated in the questionnaires and observations for this study reported that they do not use technology all the time but, when they do use technology it is for a specific purpose. A large group of teachers from the

questionnaire stated that they were becoming increasingly aware of the benefits and need to integrate technology into their teaching and learning. However, they still lacked the confidence to use it and were only beginning to replace former activities with ICT alternatives. Whereas, some of the teachers who were interviewed indicated they used ICT across all subjects throughout the day and this was like having the technology as an "on tap" resource ready to be used when required for a specific purpose. Typical responses from teachers in this study suggest this allows technology to be used as and when required.

> *I use ICT constantly in my classroom, the children do the roll before they come into class, by a click and drag method - it's used on-going throughout because it is an electronic whiteboard it doesn't get switched off, we do mute the screen and take it down to grey screen but it never gets switched off and we have activities through-out the day that we planned to user the whiteboard for but we often have incidental use of it as well were we'll start talking about something and the kids will get engaged and a particular questioning line and we will quickly Google and pull stuff up and work through so it's constantly being used (Alison, teacher - L5 country school).*

Teachers will use technology in different ways to achieve outcomes for students and ensure an overall balance in the range of approaches used within the primary classroom. One teacher wrote…

> *We write in sand, we write in water, we write with crayons, texta's, paint and on the computer. We need to use as many different ways to do writing to keep the children stimulated and engaged. The technology adds another medium and a very exciting one. I have had some grade one children who are reluctant writers on paper write reams on the computer. We need the children to be successful so we are always trying new ways to deliver learning. We also still use paper and pencils daily (Michelle, teacher - L4 metropolitan school).*

It is evident from this study and the research of others viewed via the literature that teachers still use the new technologies, mainly computers, for low-level supplemental activities such as word processing, PowerPoint presentations and searching for information on the internet. Very few teachers have demonstrated they

make ICT an integral part of their teaching and learning across all learning areas and fewer still indicated they use IC to motivate and engage students, enrich learning opportunities and stimulate higher order reasoning.

To enhance the benefits of technology use in primary classrooms in Western Australia, an effective quality assurance process is needed to ensure using ICT leads to educational gains for all learners.

5.3.2 Support structures and pedagogical change

It is the position of this researcher that for ICT to be utilised effectively in teaching and learning there needs to be a pedagogical shift in the way teachers deliver education. Technology mediated learning affords pedagogical approaches that shift the focus from knowledge transition to knowledge building and sharing (Vrasidas & Kyriakou, 2008). According to Vrasidas & Glass (2005) knowledge building takes place when teachers and learners interact with each other, collaborate, discuss ideas, form arguments and negotiate meaning. Pedagogically sound uses of knowledge can provide learning environments that enables learners to take control of their learning and become active builders of knowledge (Vrasidas & Kyriakou, 2008). According to Vrasidas and Kyriakou (2008) ICT offers real opportunities to make lasting improvements in teaching and learning and there are many reasons for the failure to fully utilise ICT in education. The study by Vrasidas and Kyriakou, also shows a gap between rhetoric, policy and practice exists and this varies from school to school. One of the participants' in this study also commented…

> *At present the rhetoric of ICT outweighs the reality. Teachers tend to do computers rather than integrate ICT. We all need to be convinced that ICT will enhance learning (Bill, teacher - metropolitan primary school).*

Barriers to teaching and learning with ICT

Researchers such as Ertmer (2005) and Bingimlas (2009) identify barriers that impede the integration of technology into teaching and learning as being centred on the issues of access, resistance to change, lack of time, training and professional learning and the lack of technical support. Throughout the analysis of the data in this study teachers and school leaders identified similar issues to those mentioned by Ertmer (20050 and Bingimlas (2009). For example, in this study, the following elements kept coming forward.

- School's capacity to support ICT integration
- Leadership
- Professional Learning

The following table (Table 58) demonstrates the possible implications for schools and teachers for teaching and learning with ICT.

Table 58

Possible implications for schools and teachers for teaching and learning with ICT

Barriers	For schools	For teachers
Lack of access	Providing ICT resources including hardware and software	Taking advantage of the resources available
Resistance to change	Professional learning (PL) in new pedagogical approaches	Being open minded toward new ways of teaching
Lack of time	provide time – creative ways to accommodate	Acquire skills of self-organisation - prioritise
lack of training and professional learning	Provide PL in dealing with new technologies and pedagogical approaches	Self-training – online courses- take up opportunities offered, collaboration and mentoring
Lack of technical support	Provide continual technical support	Develop skills/knowledge to be able to solve problems when using ICTs Access available support

Table 58 looks at the barriers identified by Ertmer (2005), Bingimlas (2009) and this study and addresses the implications for school leaders and for teachers in teaching and learning with ICT. Teachers in this study identified the lack of access to current technology, the time to explore and experiment with the technology, along with the

lack of professional development as some of their major concerns. Schools leaders identified the lack of technical support and financial resources to support effective professional learning as their major concerns. These elements are supported by comments made by the participants of this study.

Schools' capacity to support technology integration

The following comments were typical of the responses made by participants in this study.

Jane, a teacher from a Level 5 rural/remote school, wrote…

> *If it is going to be a priority the Department needs to fund it appropriately and realistically.*

This sentiment was echoed by Jim, a teacher from a Level 4 rural school, stating…

> *The Department needs to provide technological assistance to schools from professionals and not expect teachers to take on the most impossible task of maintain computer networks.*

And other participants reflected…

> *Technology needs to be used as a tool to improve learning opportunities. I would ideally like to have access to computers on call and an IWB so that I could link directly to my notebook – modelling use as I go through the lesson (Sharon, teacher - metropolitan primary school).*

> *We need to incorporate technology as a strategy and use things students are interested in to engage their learning and promote communication and production of work (Ronnie, teacher/ICT Coordinator - L4 rural school).*

On the other hand a teacher commented…

> *I am so lucky to be part of a school that adopts ICT as a priority that goes hand in hand with Inquiry based learning. More money is needed to get technology into our classrooms, such as IWBs. We do a huge amount of fundraising to keep our ICT program effective and hugely successful (Elyse, teacher L5 rural school).*

Cost and Technical support

There has been a debate about access, cost, training and quality of computers in schools over the past thirty years and while it is an essential tool for learning, researchers like Elliott (2004) and others have found that even though Australian schools are in the forefront of using ICT in their teaching and learning, ICT is still mainly used for word processing and research. This is supported by the comments made in this study.

One principal commented…

> *While some teachers, even some schools incorporate ICT very successfully, it is still, an 'opt in' system (Fran, Principal, L4 metropolitan school).*

While the teachers stated…

> *As a teacher you need the support from leaders who are committed to the successful integration of new technologies in your school. They need to have a shared vision and are willing to oversee the implementation and be supportive (Jodie, teacher - L5 metropolitan school).*

And…

> *I would like to become more confident through further PD and support from an ICT coordinator (Karris, beginning, teacher - L3 rural school).*

With principals typically stating…

> *You have to have a really reliable infrastructure and network before you start putting pressure on the teachers to use it because if you put the pressure on and it's not reliable the frustration level rises and teachers give up really quickly (Fran, Principal - L4 metropolitan school).*

Or…

> *I think the biggest obstacle is time, having the time to sit with staff to mentor and or train them in how to use the technology let alone developing their pedagogical understanding of how to integrate it into their teaching and learning". Another obstacle is getting the reluctant users on board but we are finding ways around that. I want let them feel comfortable and find value in collaborative practise and not fearful – it*

is a trust thing that as a school we have to develop (Terry, Principal - L4 country school).

And other principals stated…

The obstacle that impacts us most is that of technical support. In primary schools we need greater support to make sure our networks are robust, reliable and available. If they are broken down every other day or crashing teachers get frustrated and say what the hell and give up (John, Principal - L6 metropolitan school).

School leadership

According to McKinsey (2007) school reform rarely succeeds without effective leadership at both the system level and the school level without sustained, committed and talented leadership. Devaney (2009) reports that school leaders must be passionate about the integration of technology into teaching and learning and they must believe technology is a tool that allows educators to personalise instruction and overcome barriers of time and place for every learner. It is the researcher's personal view that not only do leaders need to have this vision but also teachers must hold this belief and together we can provide educational opportunities to our students that will motive and engage them in the process of becoming lifelong learners. Furthermore, Kaestner (2006) believes school leaders need to understand the value of investing in technology to be able to address the critics. In this study the teachers see the lack of resources, technical support and professional learning as the inhibitors of teaching and learning with ICT. Whereas the leaders (Principals) see the lack of financial resource as the factor causes the spin off effect. In section 4.8.3 - Table 7, analyses the perceptions of participants in response to school planning and leadership. In this study there was an overall positive response to all statements in this section. A total of 60% of the participants either strongly agree (25%) or agree (35%) schools and leadership need, a clear direction when it comes to implementing technologies into teaching and learning. This suggests participants believe that schools need to have ICT planning and leadership in place. However, the data in this study would seem to indicate that implementation of ICT into teaching and learning is hindered by insufficient ICT resources.

Technical Support

One of the main obstacles identified by teachers and leaders as a barrier to implementing technologies into teaching and learning was insufficient or delayed technical support. Many of the principals commented…

> *One area of ICT that causes problems is technical support. We budget for it but only so much can be allocated in the meagre school budget we are given. Most ICT problems in schools are handled by teachers who have picked up some necessary skills but overall when major problems develop these aren't adequate. The department needs to allocate a tech support person to school clusters (Simon, Principal- L4 country school).*

Professional learning

In 2009 the Council of Australian Government (COAG) established the National Education Agreement that contributes to achieving the objectives, outcomes and targets for schooling under the proposed new Goals for Schooling Young Australians (Melbourne Declaration). This follows on from the agreements reached between the state and territory government Ministers of Education in 1999 under the Adelaide Declaration. The Digital Revolution (DER) National partnership aims to deliver system-wide reforms in education to ensure all students are equipped for learning in a digital environment and enable schools to better access the benefits of technology for their students (COAG, 2009). To do this teachers and educators need to look at using ICT more effectively. Research has shown the effective and appropriate use of ICT will liven up the teaching process, motivate students and achieve positive attitudes to learning (Ertmer, et al., 1999). Furthermore, participants in this study have reported that ICT has shown to provide students with a good opportunity to take responsibility for their own learning, both in small groups and individuall**y,** and is able to meet students' individual needs more effectively through appropriate use.

> *I have started using Mimeo board this year (2008) great as a motivation aid and as a source of modelling ICT use with students (Brian, teacher, L5 metropolitan school).*

> *I use it [technology] to introduce, develop, consolidate and revise aspects of the learning program at a whole class, group and*

individual level. It is a great tool used by students across learning areas to cater for their particular needs (Leah, teacher - L5 country school).

As students' progress through the year levels, they will spend more time engaging in collaborative work and participate in more project-based instruction. Through these programs, students can direct their own learning and readily engage in problem solving and critical thinking (Rebecca, teacher - L5 metropolitan school).

As an added bonus, ICT enables teachers to access a wealth of resources that are now available online.

Ertmer, et al., (1999) stated professional learning plays an important part in developing a person's confidence and competence in implementing any strategy and that it needs to be targeted to meet the individual needs of the recipient. In the questionnaire participants were asked to identify their main source of professional learning. It is interesting to note the percentage of participants (see Table 6, section 4.8.2) who indicated the majority of their ICT skills and knowledge were self-taught. Schools mainly concentrated on providing professional learning in those areas that linked directly to the overall operations of the school. For example SIS (*Student Information System*) was the highest offered professional learning opportunity present to the participants whilst applications like presentation software and Movie-maker where the least offered PL opportunities. In conclusion, the majority of the participants surveyed in this study indicated their ICT skills and knowledge were mainly gained through self-instruction.

In conclusion, the majority of the participants surveyed in this study indicated their ICT skills and knowledge were mainly gained through self-instruction. This is an important outcome and may be linked to the need to ensure teachers have access to good technology and a reliable and fast internet connection at home.

Throughout the interviews and classrooms observation process many participants stated…

> *Our school was involved in and implemented the LwICT in 2008 which gave us a curriculum leader in our classrooms. This was fantastic and encouraged me to undertake it individually in my own class (Karris, beginning, teacher - L3 country school).*

> *I find the resources offered by DET through eLearning fantastic. It makes my teaching and learning program fun and exciting and I can tailor make my web quests for any topic I choose (Renae, teacher - L5 metropolitan school).*

Renae goes on to reflect…

> *Teacher made Power-Point activities is my favourite but self-made quizzes and tools like Inspiration are a hoot. The kids love Movie-Maker and Swatch. All these fit into the inquiry learning tool so well (Renae, teacher - L5 metropolitan school).*

5.3.3 Teacher attitude toward change

Effective teachers use the power of ICT to promote the uniqueness of a topic or theme and the skills related to particular groups. They have a clear understanding of the learning process as it relates to the theme and are confident the technology will help improve the student's capacity to learn. Effective teachers assess the impact of students' use of ICT to ensure there is added value to the learning and teaching progress. Teachers made the following comments during the interview process:

> *Most teachers use the computers as a reward or time filling exercise for students who have completed other work, whereas I always have a new task for students to go on to if they have completed the set task ahead of time (Jodie, teacher - L5 metropolitan school).*

> *The Word, Publisher and PowerPoint programs lead to more students writing and writing of a higher quality, while using the Internet, in a guided form, increases access to information and assists in improving research analysis skills. Through these programs, students can direct their own learning and readily engage in problem solving and critical thinking (Brice, teacher/ICT coordinator - L5 metropolitan school).*

However, one of the impediments to the integration of ICT in teaching and learning is the traditional pedagogical methods and approaches as well as the old curriculum taught in schools. Teaching and learning should focus on student-centred pedagogical approaches. According to constructivism, learning comes from construction, collaboration, reflection and negotiation in a rich learning environment that promotes the effective use of technology. The following comments were made by teachers when asked about integrating technologies into their classroom practice…

> *I started playing with the use digital cameras and bring the classroom alive with what we were doing and using kids real experiences and having them up there in full colour and linked to their text and writing (Alison, teacher - L5 country school).*

While another teacher reported…

> *I find that's my biggest thing about ICT is that I can provide real context for kids. I can capture what we really do in activity based learning through photographical, digital video evidence and get the kids connected back to that activity when we are reflecting or reviewing (Elyse, teacher - L5 country school).*

and another teacher stating…

> *We use ICT a lot for publishing and developing some keyboard skills because I guess what we are doing is activity based getting the kids to think together. A lot of the time they are doing that using other tools and strategies and we are using the computer more as a reporting back tool, a publishing tool or a research tool and we are trying to investigate something that we can't investigate in other ways (Janet, teacher - L5 metropolitan school).*

If educators want students to be effective lifelong learners then they need should facilitate learning opportunities that integrate ICT in teaching and learning and develop successful use of new technologies. To enable teachers to effectively integrate ICT into their classroom pedagogy, they need support to change their pedagogy in practice. This includes time to develop the necessary skills, knowledge and understanding of how this change can and will support the effective integration of ICT into teaching and learning. But not all teachers/educators agree, as stated by the following teachers.

One teacher said…

> *Firstly, I worry that teaching has lost of sight of 'education for all.' The progressive dependence on computers and internet will disadvantage less affluent families (Mary, teacher L5 metropolitan primary school).*

> *Secondly, using technology is not learning - just as using a remote control does not teach you about television. You are the slave to the technology; not the technologist" (Blake, teacher - L4 remote country school).*

While another teacher reported…

> *All this technology is well and good. However, unless it is accompanied by teacher professional development aimed at equipping teachers with the skills and confidence to achieve educational outcomes using technology, it is effectively useless. There are too many schools who (that) have been equipped with hardware, for example interactive whiteboards, but have not been able to access the training to get the most out of them. Many of the schools who achieve great things with the hardware have done so based on the individual teacher's initiative and drive. It would be highly beneficial to see the federal government support this professional development but it is much easier at election time to point to a new building than to a teacher's new skills! (Eloise, teacher - L5 country school)*

Whilst another teacher stated the following…

> *I've only just completed my DipEd as a very mature aged student. The amount of technology in some classrooms just astounds me. It also saddens me when it is utilised in a way that the Education Department didn't mean for it to be used (Delanie, graduate teacher - L4 metropolitan school).*

As teacher attitudes toward ICT effect their motivation to learn and integrate ICT into their teaching and learning it is important to understand teacher attitudes toward ICT (Ertmer, 2005). The majority of participants responded to the questionnaire in a positive manner indicating teachers' attitudes toward ICT in primary school were very positive. There was a 67% to strongly agree that ICT does have a role to play in

primary school education. There were, however, 3% of the participants who felt ICT did not have a place in primary school.

5.3.4 Importance of school leaders

The school and system leaders need to recognise the need to provide all learners within education the support and encouragement to use ICT independently to promote lifelong learning. In addition to pedagogical changes the curriculum as well as student assessment needs to change to effectively integrate ICT into teaching and learning, therefore, traditional assessment methods need to change. Traditional assessment approaches do not take into account the new technologies and pedagogical approaches required. Proactive and effective leadership ensures the ICT skills of individual members of staff are kept up to date by embedding the use of ICT into the strategic plan and promoting a vision for the integration of ICT across the curriculum. They are willing to consider relevant restructuring of approaches to learning and teaching and to provide professional learning in the use of ICT for all staff.

Many teachers indicated on their surveys that they felt leadership was an important element in effective technology integration. The following comments made during the data gathering process are an indication of the consensus of opinion.

Judy, a teacher at one of the country schools surveyed, commented…

> *Our ICT Coordinator and Principal has worked incredibly hard at fundraising to cable the school appropriately with very little funding from the government.*

While other teachers said…

> *It is important that you have a leader to lead and it is possibly fair to say at this school we have a shared leadership model that is good and it is not just one person doing the driving (Elyse, teacher L5 country primary school).*

While a leader stated…

I stopped saying no to suggestions and proposals and now say how and that changed my mindset and that was critical. If I had been blocking or slowing down we would not have moved as far. Flexibility is the key and this is not just something that comes from the top but from all levels. It is not a case of me winning that is not important it is that we are winning and the focus is on the kids that is what's important (Gary, Principal - L5 country primary school).

In this study, participants of the questionnaire indicated teachers are aware of the benefits ICT with 70% stating they are beginning to replace former activities with ICT alternatives. While 64% acknowledge that teachers are familiar with appropriate use of ICT and can integrate it into many aspects of their teaching. However, only 50% believe that the potential of ICT has been exploited to enable approaches that could not be easily replicated by traditional means. This suggests that there is not a lot of confidences in the sample group that technology use today offers an improvement in the way things are done in the classroom. Data from this study suggests that there is a lot of room for improvement in the way that technology is utilised in schools.

As stated by Prensky (2005) students are discriminating consumers and users of technology and are fully aware that teachers are not. What students instinctively realise is that they need help and guidance from teachers and educators who are preparing them for their future, but teachers also need assistance from students to collaboratively learn how to best locally apply what they know. The following comment supports this notion

As always it is the teacher and parent that must make education relevant to students… Technology must become an inclusive tool where all can have access to hardware and applications. For many students it is 'the thing'. If we can help them use and integrate technology into the classroom with support from the teachers and parents then students will be more engaged and connected with their learning… remember it is only technology for most people over 25, to everyone else it is just what you do. Schools need to embrace it and ask students to step up and create too. Use the knowledge they have to assist *others and teach. A great way to learn (Artful teacher 2010).*

However, Oberg (2004) advocates technology is an important adjunct to learning, but the classroom element still needs to be considered because

"someone leaving the school system with vast amounts of knowledge with little or no social skills is not necessarily a good functioning member of society".

The problem is many of these teachers and educators are not living in the present so how can they prepare students for the future when they, themselves are not prepared for the present" (Vrasidas & Glass, 2005). Teachers and educators must change the way they deliver the curriculum to students if education is going to be relevant to them in the future. The use of ICT should be driven by the desired learning outcomes. However, once the decision is made to integrate ICT into teaching and learning, teacher's pedagogy needs to change to ensure effective ICT use (Trinidad, 2001).

One teacher stated…

> *Students need to build the ability to learn a new technological skill quickly. So might as well start practicing now. If teachers and schools don't use the tools the kids love today, they will lose them. Teachers simply MUST keep up (Jane, beginning teacher L4 rural primary school)..*

However, not everyone holds this view as can be noted by the following comments.

> *I am nearing my 60s so in reality you would be better off talking to the young ones as I don't see that it is part of my role (Julie, teacher, L6 metropolitan school).*
>
> *I think we need to make allowances that some teachers are still valuable even if not computer literate. I would prefer to send the children to someone else for teacher-directed computer time I don't want to do it myself to be honest I like my old methods and aren't able to learn new tricks (Merle, teacher, -L5 metropolitan school)*
>
> *While I have a job-share partner who is willing to do the 'computer thing' I don't have to worry about it. I feel that in my classroom the kids are getting the best of both worlds (Kaylene, teacher - L5 metropolitan school).*

5.4 Support Structures and Pedagogical Change

To address the overall research question the following sub-questions were examined.

> What support structures are required to encourage teachers to make pedagogical changes for the successful implementation in the primary classroom?

Research findings indicate teachers have a strong desire to integrate ICT into their teaching and learning, but encounter many barriers (Bingimlas, 2009). The major barriers to ICT integration common across most research are:

- Lack of confidence and competence (internal barriers)
- Access to resources; for example: hardware/software; professional learning; time; and technical support (external barriers)

Certain characteristics of the school, such as equipment, time, technical assistance and leadership may act as either enablers or inhibitors of technology use (Smerdon, et al., 2000). Researchers have found that whenever the topic of ICT integration is investigated the respondents continually refer to these barriers as to the reasons why ICT integration does or does not happen at their school. Ertmer (1999) refers to these barriers as either first order (extrinsic) or second order (intrinsic) barriers. She explains first order barriers as barriers extrinsic to the teacher such as access to equipment, insufficient time for planning and collaborating, insufficient or lack of technical and or administrative support, and professional learning. In the category of second order barriers Ertmer (1999) identifies barriers intrinsic to the teacher and include attitudes and beliefs about teaching and how children learn, attitudes and beliefs toward and about ICT and its role in education, established classroom pedagogy and the confidence and or competence to change. This study found teachers cited similar obstacles as to the reasons for impeding their development of teaching and learning with new technology.

Through the questionnaire participants were asked about the school capacity in regard to ICT resourcing and indicate the availability of ICT resources in their school. It can be noted in table 5 (p. 134) that all resources were available to some degree and the most commonly used resources were the internet and digital camera. When computers for personal use was examined as a factor, 90% of the participants indicated the notebook for teachers program and 81% indicated PCs/desktops were available; however, only 67% of participants used the notebook for teachers program and 57% use the PCs/desktop computers available to them. This would suggest even though technology (computers) were readily available in schools teachers did not access these. During the interview and discussion sessions teachers commented:

> *More computers would make ICT a little easier; we have access to fourteen laptops which makes whole class instruction a little difficult (Karris, beginning, teacher - L3 country school).*

> *I would like increased access to laptop/desktop computers in a lab with one computer for each student in the class. I would also like more ICT coordinator time (Jane, teacher - L5 rural/remote school).*

> *The network working consistency and the number of working computers increased (Natalie, teacher - L4 country school).*

> *To access to more funding to enable better implementation of the program as the sharing of equipment across classes is problematic (Ray, teacher - L5 metropolitan school).*

Results from this study suggest that even though schools report to have the required ratio of computers to students, teachers do not feel that this is adequate for their needs. Many teachers inferred throughout the study that if there were more computers, even a one-to-one computer ratio, this would make a difference in the level of ICT integration into their teaching and learning practices. Larkin & Finger (2011) conclude that even with one-to-one computer programs the daily usage of computers by teachers and students was not substantial greater.

When asked about technologies such as Interactive Whiteboards there were a large proportion of participants (86%) who indicated data projectors were available, but only 56% of participants used them. There were 68% of participants who indicated Interactive Whiteboards (IWB) were available however, only 46% of the same participants have used these.

> *More money is needed to get technology into classrooms, such as interactive whiteboards. We do a huge amount of fundraising to keep our ICT program effective and hugely successful (Elyse, teacher - L5 country school).*

While many first order barriers may be eliminated by securing additional resourcing and providing professional learning opportunities to up-skill teachers, the second order barriers can be more challenging as you need to confront people's attitudes and beliefs as well as the traditional routines of one's practice (Ertmer, 1999).

> *I use technology in many different ways and have students using web quests, interactive games and productivity programs like Inspiration/Kidspiration to brain storm and map out ideas, Word and PowerPoint to create visual presentation like visual poetry, music creator programs to explore and make their own musical tunes to add to photo stories and movies (Jodie, teacher - L5 metropolitan school).*

Therefore, it can be noted from this research that ICT resourcing does not seem to be a barrier in the respondent's schools. ICT is available but a teachers' decision about whether or not to utilise what is available may be a greater influence on technology uptake. One other aspect that this study investigated was the ease of access to these resources and to professional learning activities.

This study would suggest that for the successful implementation of ICT into teaching and learning schools need to examine their current pedagogical practices and beliefs about how students learn. To do this, teachers need to be supported through:

- Leadership and mentoring
- Curriculum and assessment reforms

- Professional learning
- Access to technology

According to policy makers worldwide ICT in schools should lead to significant educational and pedagogical outcomes and be beneficial to both teachers and students (Ofsted, 2002). With emerging new technologies teaching and learning should evolve from an emphasis on teacher centred to student centred interactive learning environments. In reality teaching and learning practices and curriculum have remained essentially unchanged and technology underused and poorly integrated into the classroom (Cuban, 2001). Even though ICT infrastructure in schools has improved substantially over the years, teachers do not appear to make effective use of the ICT tool in teaching and learning. It seems attitudes and skills still remain a barrier for teachers to adopt and make effective use of ICT. Since the late nineties and early 21st Century a number of initiatives from DoE has been directed towards preparing teachers, leaders and schools to integrate ICT in their everyday educational practice.

As mentioned previously the DER**,** under the Adelaide Declaration, saw the national push to have every school connected. For ICT to be integrated into teaching and learning it is important that teachers gain technical skills as well as pedagogical knowledge of effective instructional practices that incorporates meaningful uses of technology (Ertmer, 1999). To this end, DoE implemented the '100 schools' project which went on to be part of the bigger picture and involve OCS (online curriculum service). Alongside this initiative DoE implemented the 'Notebook for teachers' program and 'Partnerships in learning' initiative. The 'Partnership in learning' program was an online professional learning initiative that provided teachers and interested education assistants with free access to the 'Teachers have Class' professional learning. These initiatives were designed to raise teacher's ICT knowledge and skill levels and foster positive attitudes towards ICT as a teaching tool. However, respondents commented on the questionnaire …

I much prefer professional learning to be run by a human rather than on-line professional learning as the lack of this type of professional learning is stifling my development on this area (Tracey, teacher - L4 country school).

In 2006, DET**,** through the Evaluation and Accountability division, conducted a similar survey to this study of 1500 primary and secondary teachers. The findings found the following support was required by schools/teachers to increase teaching and learning with ICT:

- more computers and better access
- reliable and up-to-date computers and connections
- improved technical support
- more time to develop lessons/access teaching resources
- teacher support

This study has similar findings to the DET (2005) study as results from this research indicates support for the school; leaders and teachers is paramount for the successful integration of ICT into teaching and learning. Teachers need support not only from DoE, and curriculum reform but also from positive mentors and leadership. The majority of schools have the capacity to support ICT integration through the provision of a wide range of new technologies. In the interviews and discussions one area of concern was technical support with participants offering the following insights…

I would love to see a computer technician, with a specialist understanding of the school's needs, to be attached to a Hub of schools and to be available weekly to ensure that the technical aspects of the network are operating smoothly (Raelene, teacher - L4 metropolitan school).

Government/DoE need to provide technical assistance to schools from professionals. It should not expect teachers to take on the almost impossible task of maintaining Computer Networks (Brice, - teacher/ICT coordinator - L5 metropolitan school).

> *We need more on-site technical support –it is stressful when something doesn't work and that is when people give up (Shannon, teacher -L4 rural school).*

> *We need tech support – our system it is for ever breaking down, a fair bit of our ICT budget is used to pay for tech support. It would be nice if DET had dedicated tech support for school (Roger, Associate Principal - L5 metropolitan school)*

> *There is a huge range of abilities and motivation of teachers to engage in the curriculum. A robust network is a complete must to ensure staff who are just embarking on the technological journey can be kept 'on-side' otherwise they become disillusioned and give up. The Notebook for teachers (Nb4T) is a great idea; however at our school even fairly new (1 year old) notebooks are falling over (Fran, Principal - L4 metropolitan school).*

However, in the questionnaire 73% of the respondents indicated technical support was available but only 54% accessed or used this support.

Professional learning

Another critical element to successful integration was teacher confidence. Some teachers felt they needed more professional learning (PL) and not just a 'one off'. Respondents made the following comments when asked what support they need to be able to successfully integrate ICT into their teaching and learning.

Many teachers made comments about the need for more professional learning, with one teacher stating…

> *I need to learn to use the technology unique to school… Given PL not just a flash sighting/sample of particular programmes and left to figure out all the nuances, isolated in the classroom (Marie, teacher - L5 metropolitan school).*

Others said…

> *I need PD, PD, PD and more PD not just putting software on the shared drive and expected to use it. I would like lessons model. I have a go but would like a guide on the side approach. I need help in the classroom (Gabrielle, teacher - L5 metropolitan school).*

Or expressed a desire to improve their skills by commenting…

> *I would like to become more confident through further PD and support from an ICT coordinator (Karris, beginning, teacher - L3 country school).*

Some principals recognised the need to technology professional learning and made the following remark…

> *Teachers need continual PD to keep them up to date with technology (Fran, Principal - L4 metropolitan school).*

Access and financial support

Another support mechanism needed to encourage teachers to successfully integrate ICT into teaching and learning is access and money. Many respondents believe more money is needed to get technology into classrooms and make it readily accessible to teachers and students. The following comments were made by leaders and teachers in this regard…

> *1. We need more money to get technology into classrooms, such as interactive white boards. We do a huge amount of fundraising to keep our ICT program effective and hugely successful (Elyse, teacher - L5 country school).*

> *2. We need more computers and money from the government to pay for cabling services and upgraded electrical supply which cannot cope in our old run down school rooms (Renae, teacher - L5 metropolitan school).*

> *3. We need increased access to laptops/desktop computers in a lab, one computer for each student in the class and more ICT coordinator time(Jane, teacher* .- L5 rural/remote school)

Time was another aspect identified by teachers as an area needing to be supported. Teachers need time to learn the new technologies, collaborate with peers to share ideas and knowledge and to be able to plan effective teaching and learning programs for the students using these new technologies. One respondent summed it up by stating that:

> *Despite receiving funding to develop ICT resources within my school the lack of basic ICT skills is low and must therefore improve (Greg, teacher - L4 metropolitan school).*

These insights were frequent amongst both teachers and school leadership who responded to the questionnaire. It seems that in order for technology to be used to its full potential teachers need to be knowledgeable and comfortable with its use.

Since the introduction of computers into schools, teacher professional development has been designed to teach teachers how to use technology in the classroom. Unfortunately, after 30 years there is little evidence this effort has been successful. Conventional wisdom suggests that the problem is a lack of professional development. This is an assumption that should be challenged. Professional learning is more complex than simply learning to use tools. In a study conducted by Prestridge (2010) it was found that "ICT professional development is seen as a vehicle to enable transformational change however, long standing perceptions of ICT professional learning as ICT skills workshops or training approaches indicates a 're-tooling' of teachers that tends to augment the existing curriculum by developing teachers' competencies focused on specific types of applications". Technology often requires changes in pedagogy and the way classrooms are managed. ICT Professional development needs to move away from re-tooling' with infrequent curriculum integration to a model that will enable teachers to see the transforming possibilities (Martinez, 2010; Prestridge, 2010). This is supported by the many comments made by the participants in this study. Teachers emphasised the need for effective PL, through the following …

> *I would like to become more confident through further PD and support from the ICT coordinator (Karris, beginning teacher - L3 country school)*

And…

> *Initially we did a little bit of skill training but now we tend to move more towards showing how ICT can be used as a tool and integrating it into the curriculum (Marion, teacher - country school).*

Furthermore, even though DoE offered online PL through the Portal many participants made the following remark…

> *I need Professional Development that is run by a human and not online. I need to collaborate and share my ideas with others (Roger, teacher - L4 metropolitan school).*

Teachers need support through professional learning opportunities and mentoring to enable them to make clear connections between technologies, inquiry based learning and higher order thinking if students are to become productive members of society and operate in the information age. In the early implementation of ICT, efforts by governments and Education systems focused on eliminating barriers by providing funding to increase computer ratios and support the up-grading of cable and electrical supplies. But it was not across the board. In Western Australia 131 primary schools out of a total of 537 primary schools in the state took part in the Learning with ICT initiative from 2002-2009. Under this initiative schools received funding to up-grade their computer technology access to the recommended standard and to employ an ICT coordinator to support staff in professional learning opportunities to enhance technology skills and integration into teaching and learning. This initiative in the early phases appeared to be successful however; schools involved in the last couple of phases became victims of the teacher shortage. Even though schools received financial funding some schools saw the program suffer because of the withdrawal of the ICT coordinator as indicated by the comment below…

> *Our school was involved in and implemented the LwICT in 2008 which gave us a curriculum leader in our classes. This was fantastic and*

encouraged me to undertake it individually in my own class. Now due to the teacher shortage, this position will become non-existent in 2009 and ICT will be left to teachers, usually only the ones who feel confident enough to teach their students. No support is being offered to assist teachers who are not confident (Karris, teacher - L3 country school).

On the evidence collected by the researcher, she feels that while some of the participants in this study are integrating ICT into their teaching and learning others are not. Certainly a difficulty with access is an issue and the lack of proficiency in using ICT may also be a factor. Teachers spoke about the time taken to search for and prepare materials for lessons along with the unreliability of the network and or computers as a compounding factor in their willingness to integrate ICT. Going hand in hand with having adequate access and support, the school culture also plays an important role. This is addressed in the next section.

5.5 School Culture

The culture and ethos of the school is significant in shaping the future of its young people through the values and attitudes of the school community. A commitment to these values will be readily apparent in classrooms and assessment practices, the daily life, management and leadership of the school. A clear shared vision will encourage dialogue and collaboration among teachers and administrators about how to create the best learning environment.

The literature reviewed indicated school cultures play a role in the successful integration of ICT. In this section we take a look at what school cultures are most supportive of pedagogical change for successful integration of ICT. This view is supported by some of the participants in this study.

To successfully introduce any innovation in a school you need an environment that is supportive and enables teachers to take risks without the fear of incrimination. If you don't have that then people are just

going to play it safe and not embrace new ideas (Fran, Principal - L4 metropolitan school).

We had an ICT curriculum leader in our classes and this was fantastic as it encouraged me to undertake it individually in my own classroom. Now due to the teacher shortage this position has been dissolved and ICT integration will be left to teachers. Usually only teachers that feel confident will integrate ICT into their teaching. No support is being offered to assist teachers who aren't confident (Karris, teacher - L3 country school).

With Ronnie, a teacher with 20 plus years' experience from a level 5 country school, reflecting

I'm keen to incorporate more but feel frustrated by the lack of support and resources available.

The principals that participated in this study made the following statements about the importance of school culture and in particular the need for distributed leadership.

Distributed leadership with coordinators roles classified right through the school with time allocated on a weekly bases the time resources needed to carry out their duties was very powerful (Mark, Principal - L5 country school).

Having a culture where mentors and curriculum leaders are spread throughout the schools and have resources available to support them (Rodney, Principal - L5 metropolitan school).

It is important that you have a leader to lead and in this school we have a shared leadership model that is good and it is not just one person who is driving it (Fran, Principal L4 metropolitan school).

With Brice an ICT coordinator and teacher from a Level 5 outer metropolitan school summing it up with…

It is important to develop the culture of the school and have a vision of where we are going.

Findings from the leadership survey indicated that 96% of the participants believe having a clear vision for ICT was either very important or important. Furthermore, 87% of the participants indicated they felt it was either very important or important to have an ICT plan that considers issues of students and staff development. Whilst, 76% of participants responded that it is very important or important to audit the impacts made by specific curriculum areas to the overall development of the student's ICT skills, including regular opportunities to practise. However**,** 16% were neutral in this area

Semenov (2005) reported that in the 21st Century the 'ever increasing need of individuals and society are placing a heavy burden on educational institutions' (p. 18). However, traditional structures and teaching pedagogy appears less responsive to the challenges and implementing change. Society is calling for 'innovation and translation among educators everywhere and in particular in the primary sector- the most critical stage in the development of the human being' (Semenov, 2005, p.18). This is supported by comments made by the participating principals.

One thing that is important is collaboration and cooperative learning. The admission that we are all learning and we don't just play lip service to that. When I go to school organised Professional Learning opportunities I am learning and every teacher is learning and there will be something for everyone (Simon, Principal - L4 country school).

We have developed an Inquiry Based learning model across the school and part of our professional learning was getting the kids into it and showing them how to use ICT in their inquiry (Mark, Principal - L5 country school).

According to Semenov (2005) students enter school being communicative, curious, creative and capable of learning anything. However, the traditional school of the 20th Century, which is still very much with us, diminishes these attributes over a period of

time. There needs to be a new style of schooling to meet the needs of students in the 21st Century.

This statement is supported by the researcher having observed teachers conducting computer lessons involving low level activities that included students typing pre-written stories and recording their attendance on an IWB (see section 4.17.3 - Classroom 3).

The old pedagogy of presenting content in a lecture format for students to memorise and regurgitate back in written form, which happens in most classrooms today, with little regard to learning strategies that provide concrete, visualised, experiential, self-initiated hands on learning experiences will not develop a child into a productive member of society in the 21st Century (Semenov, 2005). Changes are needed in the way schools are structured and teachers deliver education, with a 'focus on the process of learning and through the provision of environments and tools which encourages everyone to become successful and responsible learners' (Semenov, 2005, p.25). This does not mean that teachers are any less important, rather good teachers are invaluable and are needed to assist students to become good learners (Bransford et al., 2000; Semenov, 2005).

> *In my view technology will not take place of the teacher. Students still need to be guided and they also need to be able to talk through their ideas and a computer cannot do this (Marion, teacher - L6 metropolitan school).*

> *As a school leader I feel that you need to create a culture that supports staff to explore and take risks in using the technology. Teachers play an important role in the overall education of our students (John, Principal - L6 metropolitan school).*

Since the early 1980's education has seen an infiltration of computers in classrooms which has led to the rebirth of the thinking classroom, multi intelligences and critical thinking (Nettelbeck, 2005).

I guess my teaching is different to other staff in that the majority (all) students love to use the computers. Therefore, I do not have the same behaviour constraints rather I have only the varying levels of ability to contend with. Originally, I was attempting to bring the weaker students 'up to speed' and bridge the gap in ability; however, I have since made it more of a 'the better you are the further you will go ahead' approach. I apply humour to a lot of my teaching, using it to get the brains going and alert their thinking to allow them to make the best of each learning situation (Brice, ICT coordinator/teacher - L5 outer metropolitan school).

My general approach to teaching is to enable students to have an input into the content we need to cover for the term/year. I do this by presenting the student with outcomes we need to cover then negotiate how we will do this. The majority of activities are base around using an inquiry approach incorporating cooperative learning strategies (Alison, teacher -L5 country school).

It has long been recognised by many educational leaders and researchers that teachers, schools and systems are having difficulty coming to terms with some of the contradictions between key learning principles and practices on the one hand and pressure of accountability and traditional school culture on the other (Seaton, 2002). Seaton cites Barrett (1999), saying that research is finding that students between the age of 10 and 15 are 'switching off' and that they need to have opportunities to negotiate learning which is useful now as well as in the future. Quoting Barrett further, Seaton states that a 'coherent curriculum is focused on the identified needs, interests and concerns of students along with the emphasis on self-directed and constructive learning' (Barrett as cited in Seaton, 2002 p. 10). Seaton posits that primary schools have a long way to go in terms of providing students with opportunities to construct understandings as they use and analyse text in real context for personal and social purposes. He continues by stating that teachers in a work-oriented classroom concern themselves with information transmission focusing on mastery of predetermined outcomes, where as in a learning-oriented classroom the teacher facilitates the construction of knowledge through an emphasis on problem solving and open ended activities connected to student values, interest, purpose and

life worlds (Seaton 1999, p.13). This is supported by some teachers with a participant stating…

> *I am very lucky to be part of a school that adopts ICT as a priority that goes hand in hand with Inquiry Based learning (Elyse, teacher - L5 rural school).*

One principal responded by saying…

> *At our school we decided to explore the possibility of introducing an inquiry based learning model which is supported by ICT and embeds the higher order thinking skills. To do this we needed to professional develop the staff and as part of this PD was getting the kids into it and showing them how to use ICT in their inquiry. We had to teach them how to learn and how to research to get answers to enable them to apply higher order thinking skills. It was a great vehicle for the implementation of ICT. The time and money invested in up-skilling the staff was well worth it and we now have an Inquiry Based learning model operating throughout the school (Mark, Principal - L5 country school).*

The thinking classroom is not a new phenomenon it has been around since the early 1950s when Piaget, and then Vygotsky in the 1978, talked about constructivism. Vygotsky believed "children learn when they can make links with previous learning because they can extend their existing conceptual mental map with new learning" (Wallace, 2001, p. 7). It has been recognised and proposed by many leaders in education and research, for example, Atkin (1997) and McKenzie (2003) that the use of ICT as a tool can and will assist teachers and students to become engaged in learning and have a higher level of self-direction.

Governments are investing huge dollars introducing ICT into education to promote this philosophy of making learning more student-centred, collaborative and to encourage cooperative, creative problem solving (Kimber & Deighton, 1999). However, as in the words of Sivin-Kachala & Bialo (2001) 'technology can improve teaching and learning, but having technology doesn't automatically translate to better instructional outcomes' and Higgins (2003) concurs 'there is evidence that ICT can

help students learn and teachers teach, however, simply having more computers does not make a difference.' However, many participants in this study hold the belief that without more computers they cannot effectively integrate ICT into their teaching and learning. Many of the comments typically stated…

> *We need to have more computers in class. All children should have a laptop as part of their booklist (Gwen, teacher - country school)*

> *I have a class of 30 students and only 45 minutes in the computer lab with 20 computers. My year 7 students need access to computers daily, and I only have one computer in my classroom plus my notebook (Julie, teacher - L4 rural school).*

> *It is virtually impossible for me to use computers in my classroom as I only have 2 computers in my room (Miranda, teacher - L5 country school).*

With Nancy, a teacher in a level 4 school stated she believed…

> *An interactive whiteboard should be an essential item in every classroom.*

The findings from the survey indicated that the perceived barriers, such as the shortage of computers, software, inadequate audio visual resources and budget allocation, to the use of ICT in the classroom was not fully supported by this research. The participants of this research indicated that their school had the capacity to support ICT integration with 68% of participants compared to 16% stating ICT was a priority in their school. However, even though they reported it was a priority 57% of the participants surveyed compared to 37% felt there was a shortage of computers in their school. On a positive note, 75% of participants compared to 12% indicated they integrated ICT into their teaching and learning and 71% of respondents compared to 14% felt confident in this integration.

Nevertheless, even though participants of this study identified the lack of hardware as one of the major barriers to their ICT integration, this researcher holds the view that it is vitally important for teachers to change their pedagogical thinking to a more student-centred approach and adopt an inquiry based method along with strategies of cooperative learning. Once teachers adopt this pedagogical approach they will find integrating new technologies into their teaching a natural process (Carey, 1997). The findings of this study support this view. In table 17, where participants were asked to indicate the current situation in their teaching context in regard to students and class use of ICT. Even though 33% of respondents stated they frequently or often used ICT to engage students in independent learning 60% stated they sometimes, seldom or never do so. However, 56% of respondents stated they frequently or often used ICT to motivate students compared to 37% stating they sometimes, seldom or never use ICT to motivate students. Therefore these results suggest that these participants may lack the pedagogical understanding of how to integrate ICT effectively with the perceived limited resources available to them.

Additionally when participants were asked in this study about their professional use of ICT the most frequently undertaken task by the respondents is using ICT to create materials to be used by students. 85% of the participants in this study stated they created materials for students on regular bases, followed by 84% of participants using ICT for administrative purposes and 83% of participants using ICT to communicate with peers and colleagues.

Furthermore, this view is supported by many researchers (November, 2010; Schrum & Leven2009; Mishra & Koehler, 2006; Jamieson- Proctor et al., 2010). Fullan (2001; 2011), for example, believes for any new innovation to be successful there needs to be a change in the current perception of school organisation and management. This is not only a change in the way schools are run but also in how schools are organised and the way teachers deliver the curriculum in the classroom. Meanwhile, Cox et al., (2003) and Pflaum (2004) posit the key to successful implementation of ICT in teaching and learning requires a strong need for national leadership to enhance the effectiveness of ICT in schools and to ensure the use of

ICT is underpinned by a strong pedagogical foundation. They purport there needs to be adequate finances to maintain and replace ageing resources and provide quality ongoing professional development. This study supports this notion with many participants commenting that one of the major impediments to effectively teaching and learning with ICT is the lack of financial support to provide the necessary elements such as PD, technical support and up to date resources.

> *The leadership team is fully aware of how ICT can benefit student achievement and improve outcomes however; the budget constraints prevent us from implementing all the resources needed to address the teacher's needs (Charlie, ICT coordinator/Deputy Principal).*

> *Hardware is renewed every four years and per DET standards, however finances are hard to come by for extra ICT hardware for examples camera, IWBs. We have no plan to finance our own LwICT teacher after our LwICT funding ends (Ricki, ICT coordinator/teacher).*

Jane, a teacher from a level 5 rural school, echoed the sentiments made by many participants by stating…

> *If it is going to be a priority of the Education Department it needs to be funded appropriately and realistically.*

According to Kolodny-Cole (2003) school leaders have vast experiences in developing pedagogy, setting standards and telling teachers how to teach but when it comes to technology integration they do not always practise what they preach. She believes that for teachers to learn how to integrate technology into their programs they need to be engaged and understand the objectives of their learning while participating in meaningful activities. Kolodny-Cole (2003) and Cox et al. (2003) concur along with McKenzie (1998) that teacher professional development courses which lack pedagogical aspects are one off experiences and are less likely to be successful. For pedagogy and curriculum delivery, teachers need to know and understand the philosophy for using ICT in teaching and learning. They also believe that teacher beliefs and attitudes towards change play an important part in the adoption of technology in teaching and learning.

We have a formal plan and a timeline for when things are to happen, but the plan doesn't paint the whole picture. There are other things that happen as well. Our plan looks at connectivity around the school, also looks at some of the management issues, teacher competencies and professional learning options and how it can be used to support the school curriculum (Greg, Principal- L5 metropolitan school).

The progress of teacher competencies is plotted on the ICT Self-evaluation guide development by DET. This shows that many teachers are increasing their skill levels in most dimensions of practice across the phases (Rebecca, ICT coordinator/teacher).

UNESCO (2004) conducted a collective case study across six Asian countries and found that the education system must be responsive to change, thereby making it easier to integrate technology into teaching and learning. Semenov (2005) supports this by stating 'schools must transform itself from a machine for teaching into a learning organisation more focused on creative experiments than on prefabricated detail plans and checklists' (p.105). One of the critical factors identified by research (UNESCO, 2004) is that ICT needs to be an integral part of the education plan and have a common vision that is part and parcel of the system and schools' strategic plan to ensure its implementation.

The leadership team encourages staff to plan for integration in learning areas. However, this uptake varies amongst staff and collaborative team (Megan, Deputy Principal, L5 metropolitan school).

The school plots teacher development on the ICT Self-evaluation guide and three staff members help others which necessary and if asked. We have implemented a lighthouse class with an IWB and we plan to have teachers share with this teacher (Crystal, Deputy Principal - L5 metropolitan school).

The Evaluation and Accountability division of DET conducted a similar survey in 2006 using a comparable questionnaire to this study and found the majority of participants felt the school had a clear sense of direction and that teachers were

encouraged and supported in professional learning opportunities. With the lowest level of agreement being there was sufficient ICT resources available to meet the requirements of teachers and student. This study had similar findings with the results in this study indicating there are varying degrees of stakeholder involvement in developing and owning the ICT vision for the school, with 10% indicating few staff being involved. The vision for ICT should incorporate the 'development of multiple intelligences to increase creativity, flexible thinking and a broad cultural and humanitarian background that enriches living' (Semenov, 2005, p. 109). Technology ought not to be a driver of learning but the tool to enhance the experience. McKenzie (2001) advocates technology integration should support a solid curriculum and not dominate it.

Creating 21st Century learning environments requires courageously redefining roles of stakeholders and basic education elements (Shevalier, 2009).

Figure 32 is one educator's (Shevalier, 2008) interpretation of how a 21st learning environment might look.

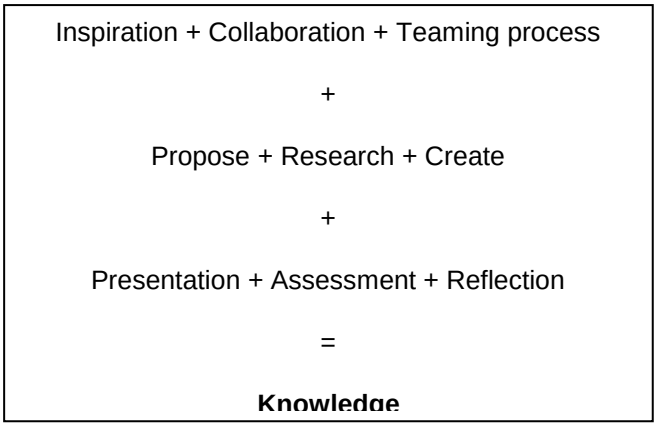

Figure 24: 21st Century Wold class learning equation

ICT is transforming the way we teach, the way in which children learn and the way in which schools are managed (November, 2010). This study shows that while there is considerable progress being made in the adoption of ICT in schools, there is a huge variation across the state and from school to school. Principals play a major

role in facilitating the implementation of ICT and influence the organisation and social culture of the school through intervention.

This approach challenges teachers to effect change in the way they teach and to incorporate ICT into their pedagogy so ICT can be integrated into the learning process. Therefore Principals have a key role as architects and communicators of the vision of teaching and learning and it will be through their involvement they can influence the role of ICT. The benefits of ICT can be promoted through the budget, professional development and by either action or inaction on the part of the Principal.

> *Our principal is a visionary when it comes to developing a learning environment that motivates and engages students and staff alike to become lifelong learners. He spends many, many hours working with the school community organising and planning various fundraising events to raise money for the school so that our IT program is maintained and enhanced to a very high level. He is also constantly promoting and encouraging staff to take on leadership roles within the school and making sure we all receive the support and professional learning we need to be able to perform our roles effectively (Elyse, teacher- L5 country school).*

It is evident from the Principals who responded to this study they collectively hold the view that school culture plays an important role in their ability to lead change within the school setting. This coupled with the notion that distributed leadership and supporting staff development is paramount to enabling change to take place (see section 4.9.3 - Table 34).

Figure 33 symbolises the author's understanding of the culture needed to ensure effective teaching and learning with ICT.

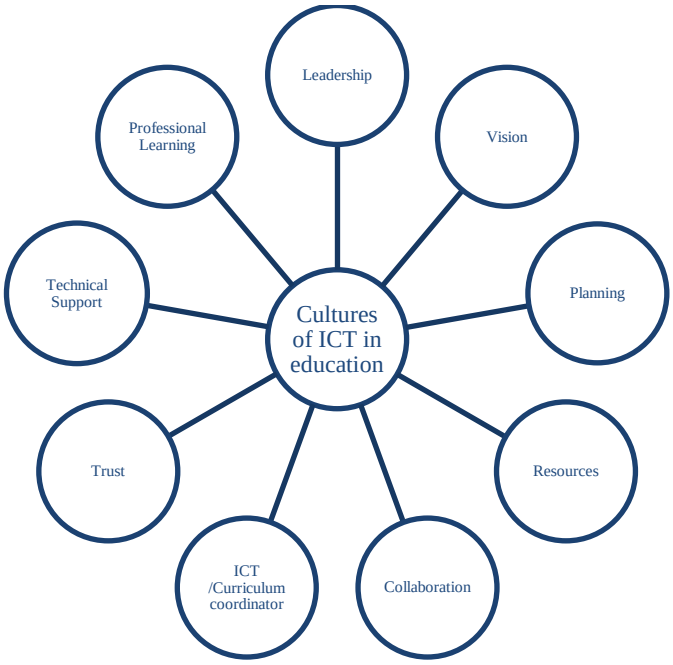

Figure 25: Culture of teaching and learning with ICT in education

5.6 Leadership

This section looks at the role leadership plays in the successful integration of ICT in the primary school. It is evident from the literature review that leadership plays an important role in implementing successful innovation and implementing new technologies effectively is no different. As previously noted leadership play**s** a vital role in developing a school culture that is supportive and nurturing of teachers' skills, abilities and knowledge.

As mentioned in section 5.3.4**,** leadership is vital to the smooth running of any organisation and schools are no different. This study has highlighted the need for strong leadership across all sectors of the organisation if technologies are going to be effectively implemented into teaching and learning. It is the researcher's view that at the system level the Department needs to have a clear vision. This is supported by the responses of the participants who were part of this research. The findings from this study demonstrated that on the whole the leaders who participated in the survey strongly believe in the need to have a clear vision and ICT plan for using ICT in

teaching and learning (see section 4.9.2 - Table 33). This has been back by statements made by the participants of the questionnaires and interviews.

> *If it is going to be a priority of the Education Department then fund it appropriately and realistically (Jane, teacher - L5 rural/remote school).*

> *I would love to see a computer technician (with specialist understanding of the school's needs) to be attached to a few schools and be available weekly to ensure that the technical aspects of the network operate smoothly. This salary should be funded by the Department and the burden not places on individual schools (Raelene, teacher - L4 metropolitan school).*

> *Government/Department needs to provide technological assistance to schools from professionals and not expect teachers to take on the almost impossible task of maintain networks detracting from their core business within the classroom (Rod, teacher - L5 metropolitan school).*

Today's teachers are faced with unique challenges never encountered or even imagined by their predecessors. Leading in this challenging environment can be daunting for any leader. So how do leaders prepare students to thrive in a global, technologically advanced society where they must use digital tools that are evolving at a rapid pace, to succeed at careers that do not even exist and beyond our wildest dreams? What role does the leader play in developing the learning environment that reflects these changes? According to Morris and Books-Young (2010), to be an effective leader for the 21st Century**,** administrators must ensure that instructional needs, the expertise of teachers and the ultimate needs of students are considered. Lee and Gaffney (2009) posit educational leaders need to engage in the process of successful change by providing guidance and advice drawn from the research and professional literature. They go on to state that leading a digital school involves far more than investing in hardware and software and implementing a technical solution. They believe it is about integrating digital technologies creatively and wisely that will enhance teaching and support student learning. ICT is more than just computers and computer hardware it is a whole range of new technology devices that can be used to capture, store and transfer information.

When speaking to colleagues about ICT integration the researcher found they immediately begin referring to computers and how these are used/integrated into their school. There needs to be a broader understanding amongst educators about the meaning of new technologies and what these are. When participants were asked how they can best use technology to improve their teaching and learning the typical comments received were:

> *Increase access to classroom computers by increasing the number of computers available as three computers to 26 students is unrealistic (Jane, teacher - L5 rural/remote school).*
>
> *There needs to be more computers so students can use them (Georgie, teacher - L6 metropolitan school).*

Many of the comments received from participants revealed the lack of computer access was an impediment to their integration of technology into their classroom practice. Whereas, Marlene, a teacher from a metropolitan school, reflected…

> *Use it as often as I can in as many different ways as possible. Technology is simply another tool in my classroom… they are constantly involved in the technology as opposed to doing technology or doing computers*

Lee and Gaffney (2009) refer to digital technologies rather than ICT or IT because they believe that it is about more than just computers.

> *The challenge of improving student engagement and achievement, developing teacher quality and redesigning schooling are the challenges of educational leadership. Developing understanding of the value and the means by which digital technologies can assist practitioners and policy makers in meeting those challenges is what leading a digital school is about (Lee & Gaffney, 2009, p. 4).*

Principal leadership has been described as the most important factor affecting the successful integration of technology into teaching and learning. Principals who demonstrate leadership are instrumental in modelling the use of technology in the classroom. They understand how it supports best practice and assessment and

provide teachers with support and guidance. Leaders who participate in professional learning alongside staff and provide teachers with opportunities to learn about ICT integration demonstrate their commitment to ICT integration thereby playing a pinnacle role in changing attitudes and beliefs about ICT in education.

With this in mind the participants of this study provided this insight into why they believe change does not happen:

> *The reason why change does not happen seems to be centred on teachers' beliefs and attitudes, political point scoring and parental opposition (Jan, Associate Principal - L5 metropolitan school).*

> *Parents are supportive of change, however when it comes to their children tried and tested procedures must prevail. From my personal experience in the classroom where I tried to introduce new pedagogies, it was the parents who objected and were most vocal and the principal would not support the changes if parents complained (Heather, teacher - L6 metropolitan school).*

> *It is difficult to try and get change into schools when the leadership and parents are not behind it. It is hard enough to get reluctant teachers to change their pedagogy and try new ideas without these road blocks. They will not try anything new unless support is in place (Alison, teacher -L5 country school).*

> *If individuals and the school do not take ownership of the change it will not be sustained (Francine, Principal - L4 metropolitan school).*

The evidence in this study suggests leadership plays an important role in the overall implementation of ICT in teaching and learning. It may not play a direct role in so much as the Principal is driving the integration by modelling the process. However, if teachers feel the principal has some understanding and knowledge of why and how new technologies can enhance student outcomes they are more likely integrate ICT into their teaching and learning. The findings suggest school leaders are fully aware

of the importance of providing support and guidance to staff when it comes to implementing ICT in schools, with 94% indication they believe it is very important or important to provide opportunities for staff to practice their ICT skills.

5.7 Teacher Attitude

The evidence from the literature indicates teacher attitude is one of the most important factors in adopting any innovation. In this section we look at the implications teacher attitude plays in the successful integration of ICT in the primary classroom.

Most policy makers, practitioners and parents believe that wiring schools, buying hardware and distributing it throughout the school will lead to successful use by teachers and students and improve teaching and learning (Cuban, Kirkpatrick & Peck, 2001). However, in reality we know this is not the case and research indicates it is more complex than that (Gaynor, 2004; Honey & Moeller, 1990; Newhouse, 2002).

Before any educational reform can effect change, the attitudes and beliefs of all stakeholders will play an enormous role in the implementation and integration of ICT However, this view is not unique to ICT. Educators and researchers such as (Ertmer, 2005; McKenzie, 1999, Nespor, 1987; Vrasidas & Kyriakou, 2008), to name a few, report that although the conditions for successful technology integration appear to be finally in place, including infrastructure and increase access to technology, teacher professional learning – whether it be face to face or on line, and reform to curriculum policies high level technology use remains surprisingly low.

For the successful integration of technologies into teaching and learning research literature has identified four elements that need to be considered. These are:

- Access to technology

- Professional learning to up-skill teachers
- Curriculum reform
- Teacher attitudes and beliefs

The first three are identified in the literature as extrinsic or first order change and are often cited by teachers as being the reason for not integrating ICT into their teaching and learning (Ertmer, 1999).

5.7.1 Attitudes toward ICT

As teachers attitude towards ICT affects their motivation to learn and integrate ICT into their teaching and learning it is important to understand teachers;' attitude toward ICT. The findings of this study demonstrate on the whole teachers' attitudes toward ICT in primary school was very positive with 67% strongly agree that ICT does have a role to play in primary school education.

Becker and Ravitz (1990) theorise teachers who hold a traditional teaching philosophy and who believe their role is to transmit an extremely rigid curriculum through highly controlled pedagogy are the teachers who may avoid technology. In this research similar first order barriers were cited by teachers and leaders when asked about ICT integration, for example:

> *I have been unable to integrate ICT Technology into my teaching learning due to severe lack of computer resources (Toni, graduate teacher - L4 metropolitan school).*

> *It's virtually impossible for me to use technology (computers) in my classroom as I have each group for 40-45 minutes and only two computers. The best use I have made of them is by using science software to assist the learning of disabled students (Miranda, teacher - L5 country school).*

The fourth area is commonly labelled as intrinsic or second order barriers as these barriers confront the fundamental attitudes and beliefs of the teacher which requires new ways of doing things. This is evident in the following comment:

> *I believe the integration of ICT is extremely important; however students still need to be taught skills. Our year seven students still type with two fingers, they also need to be taught that not all information off the web is true, that copying and pasting of images and text without acknowledgement is copyright and plagiarism can have serious consequences. Spell checker cannot take the place of proof reading. Before you can teach with ICT there are some fundamentals of ICT which must be taught (Miranda, teacher - L5 country school).*

> *Using ICT is all well and good but I have 28 students all at different levels that need to cover this work before the end of the year. How is a person support to do all this and still get the work covered? I find that we are expected to do more and more and the curriculum is becoming over crowed. For me I think the computer thing should be left for the home (Roger, teacher - L5 metropolitan school).*

> *How are we supposed to get all these things done when we are expected to make sure the NAPLAN results are up? I don't have time to do computing as well as making sure the students can do the NAPLAN testing (Michael, teacher - L5 metropolitan school).*

Although many teachers are using technology, it is for a number of low level tasks such as keyboarding, skill and drill**.** High level uses are still very much in a minority (Ertmer, 2005; Jimoyiannis, 2007). Research by Veen (1995) indicated teachers will adopt new technologies when they can use it in accordance with their existing beliefs and practices. This study provides evidence which supports this view. Assuming they all had sufficient access; teachers were able to gradually employ the new technology in a way that matched their existing practices, albeit with hard work but relative ease.

> *I found that I could purchase good educational products with Alternet CD ROMs and links to internet websites, the main producer of these products being Ready-Ed Publications. So with this as an inspiration, I*

set off to integrate ICT into my science topic "Insects and Spiders". At that stage we had an ICT teacher who taught the children how to use the various applications and programs that were on the computers into the ICT room so I didn't investigate this side of things very much. I scheduled an extra hour in the lab and embarked on this new way on using computers. The children were totally focused and the unit on "Insects and Spiders" was so well accepted that I quickly purchased another book so I could continue (Classroom teacher A).

In this research the computer related activities in which the teachers engaged students included word processing, Internet research and watching visual media. Very few teachers had their students use ICT to communicate with others or to undertake any higher order collaborative work (see section 4.8.5 - Table 13).

According to Ertmer (2005) technology use tends to be associated with teacher-centred practices while high level uses can be linked to student-centred practices**.** BECTA (2003) supports this by stating relatively few teachers readily use ICT for instruction and even fewer integrate ICT into teaching learning in a way that motivates, enriches learning and/or promotes higher order thinking.

This is evident from the following statement made by a teacher in this research:

Technology needs to be used as a tool to improve learning opportunities. I would ideally like to be able to have access to computers on call and a whiteboard so that I can link directly in my laptop –modelling use as we go through lessons. We need to incorporate technology as a strategy and use things students are interested in to engage their learning and promote communication and production of work (Raelene, teacher - L4 metropolitan school).

Teacher's attitude towards ICT and education has significant influence on ICT integration into teaching and learning. It appears even though teachers recognise the importance of ICT into teaching and learning, they tend to be less positive about its use and benefits in the classroom and its potential to improve teaching and learning (Cox et al., 2003).

> *At present the rhetoric of ICT outweighs the reality. Teachers tend to do computers rather than integrate ICT. We need to be convinced that ICT will enhance learning (Bill, teacher metropolitan school).*

Most of the respondents in this study were positive about ICT. Overall, teachers perceive it as a tool for improving teaching and learning and recognise it place in primary school classrooms. Nevertheless, it is interesting how regardless of the positive view of ICT a large percentage of respondents indicated ICT as time consuming and/or difficult.

The findings of this research suggest respondents are aware of the benefits of ICT in enhancing and transforming teaching and learning, but lack the confidence to integrate ICT successfully. Teachers are also aware of the need for and the support of an ICT coordinator/teacher. This was evident when respondents were asked about integrating ICT into their teaching and learning. Their responses showed their teaching approaches were essentially unchanged and ICT was underused or poorly integrated into their classroom pedagogy. It appears their skills, knowledge and attitudes remain an obstacle to the successful integration of ICT into teaching and learning. This is not unique to this research others have reported similar findings (Dexter et al., 1999; Ertmer, 2005; Vrasidas & Kyriakou, 2008).

One participant commented that:

> *In my view many teachers still hold the view that teaching is about them delivering the curriculum to students and the student passively receiving the information. They do not believe the student is capable of exploring their own learning needs. The way the curriculum is delivered needs to reflect the changing pedagogy if we are going to meet the needs of a students and prepared them for the future (Jan, Associate Principal - L5 metropolitan school).*

Andrews (1999**),** referring to the use of ICT, states that many teachers appear to be unable to reconcile their professional beliefs, with the value of student-centred

learning. The introduction of ICT may impart knowledge to the student and consequently create a possible threat to the teacher's traditional role. Somekh and Davis (1991) and Atkin (1997) suggest this phenomenon is highly dependent on a teacher's individual assumptions with regards to loss of control and threats to knowledge base.

5.7.2 Professional values

One of the major influences of technology use it classrooms is that of teachers pedagogical preferences. Ertmer (1999) classified these influences into two categories either first or second order barriers. First order barriers relate more to the physical technology environment and include the availability and access of technology hardware and connectivity whereas, second order barriers refer to the personal agency of people involved in technology environments. This includes ICT competency and pedagogical approaches to technology use. It has been noted in the literature (Larkin, 2011) even the perceptions among teachers, that there is limited support and guidance from school based and system staff, can be enough to hinder their technology use.

The finding of the survey demonstrated even though 72% of the respondents indicated they were developing their ICT skills, knowledge and abilities to exploit the potential of technology in education often if not frequently only 51% actively sort out opportunities to share this knowledge and understanding with others.

This indicates that participants in this study may not feel totally comfortable or competent in their own ICT knowledge to share with colleagues.

5.8 Professional Learning

In this section we take a look at the skills teachers need to empower them to integrate technologies into their classroom practices and how professional learning plays a role in the successful integration of ICT in the primary classroom. The evidence from the

literature strongly indicated professional learning as a vital component to any innovation and should therefore be one of the major aspects of any planned innovation.

5.8.1 Empowering educators

This section discusses the skills teachers need in order to empower them to integrate ICT effectively into their teaching and learning programs. It is evident from the literature and the comments received through this study, teachers and leaders need to increase their pedagogical competencies to be able to integrate new technologies into their teaching and learning. Fullan (1992) claims educator's visions of the potential for educational change with new technologies underestimates how difficult it is for teachers to implement the changes required in their practices and skills, as well as in their educational beliefs.

Besides the obvious skills required for using new technologies, teachers need to be continually updating their pedagogical skill set and critically reflecting on their teaching and learning practices. Lee and Winzenried (2009) posit if teachers are to use new and increasingly sophisticated technologies wisely and appropriately then they not only need to be comfortable and confident in their use, they must also understand how best to use the tools to improve their teaching (p. 11).

> *As a leader I take part in the 'T parties' (technology workshops) which are run on a needs basis and we all contribute and combine our resources to help each other. I model that I use it myself and therefore I am able to support and help others as they need it (Jean, Principal - L4 metropolitan school).*

> *We have introduced the 'Inquiry Based Learning' model across our school as well as provided professional development in 'Habits of the Mind' and 'Cooperative Learning' strategies. These programs were put in place before we introduced ICT and this has helped with the integration as they go hand in hand (Mark, Principal - L5 country school).*

Many educators believe technology can be the catalyst for educational reform and the relationship of the teacher and the student will change whereby students will control their own learning whilst seeking the support and guidance of a good teacher (Means & Olson, 1995; Monteith, 2004; Mosely et al., 1999). However, not all teachers use technology in their teaching and learning let alone allow students to control their own learning. This is evident by the comments made in this study by a few reluctant teachers.

> *I am nearly sixty and feel that I don't need to know about this ICT stuff because I am nearly ready to retire and can't see the point (May, teacher - L5 metropolitan school).*

> *All this technology stuff is well and good but why do they need to use it in primary school. We have too much other stuff to get through like making sure the kids get good NAPLAN results before worrying about using computers. They can do this at home (Michael, teacher - L5 metropolitan school).*

> *How am I expected to cover everything the kids are meant to know by the end of the year and cater for all their different needs? It is ridiculous we are expected to do everything (Amanda, teacher - L 5 metropolitan school).*

However with this said, it is not all doom and gloom, there are some teachers who may not consider themselves trail blazers but understand that even though it may be difficult for them to get their head around all this technology they do see its place in education. One of these teachers reflected.

> *I think we need to make allowances that some teachers are still valuable even if not computer literate. Computers are valuable, modern and useful tools that I know aren't going away I realize because young people are so comfortable and dependant on them, we must put this to our advantage as educators. But sadly I mourn to old days and can't really see myself being truly of any value in the area of ICT. The next generation of teachers will probably all be able to use*

computers as a valuable tool which will probably be a good thing (Daphne, teacher - L5 metropolitan school)

Lee (2009) states teacher acceptance as the key to the use of technology in teaching and learning. He goes on to report that time and time again throughout the 20th Century no apparent effort was made to understand why the vast majority of teachers were not prepared to use the emerging technologies in their teaching and learning and how this situation was still to be found in more reactive schools and education authorities in 2008 (Lee & Winzenried, 2009, p.10). Even though research and the researcher's personal experience support these sentiments made by Lee & Winzenried (2009), there is a small amount of evidence to suggest this is changing for some teachers in a few schools as noted in the following comments.

The kids love using Movie Maker and Inspiration, these fit into the inquiry learning tool so well (Renae, teacher - L5 metropolitan school).

Integrating technology is fantastic and makes teaching fun and exciting. I can tailor make lessons to suit any topic I choose (Renae, teacher).

My biggest thing about ICT is that I can provide real context for kids by having great images up that are real and get kids to connect with what we are talking about and exploring. I can capture what we really do in activity based learning through photographical, digital video evidence and get the kids connected back to that activity when we are reflecting or reviewing (Alison, teacher - L5 country school).

Technology is great it can motivate and engage students at all levels. I use it to introduce, develop, consolidate and revise aspects if the learning program at a whole class, group and individual level (Jan, Associate Principal - L5 metropolitan school).

Traditionally teachers have been considered as the holders of all knowledge and students the empty vessel waiting to be filled. But things are changing –students are no longer passive and they want to take control. Technology has been the instrument in this change. Students**,** through technology, now have access to a vast

range of information; they do however, lack the skills to make critical judgements about the accuracy of the information on offer and**,** therefore, need the guidance and support of a good teacher to assist them (November, 2010; Newhouse, 2010). The teacher requires necessary skills to direct the student and facilitate instruction which enables students to be critical users of technology. If teachers are going to be relevant to student learning, it is important they possess the skills to construct student centred classrooms thereby allowing students to work in active ways to construct their knowledge (Dexter et al., 1999).

Research literature emphasises access, technical support and training as the key to successful educational reforms via technology. However, research from this study would suggest teachers need more than just technology skill training otherwise they will just employ ICT for drill and practice and other low level tasks. They need support and guidance in constructing their knowledge and understanding on how to use technology to engage in higher order thinking and reflection so as to enhance student outcomes.

> *I would like to become more confident through further professional learning (Karris, teacher - L3 rural school).*

> *We need more on-site technical support. It is a stress when something doesn't work and that's when people give up (Shannon, teacher - L4 rural school).*

> *We need an ICT curriculum specialist so that I can learn alongside my students (Ronnie, teacher - L5 country school).*

> *I need time to play and explore alongside the support of an ICT curriculum specialist who can help me plan and execute the program in my classroom. A guide on the side approach (Sheryl, teacher - L4 rural school)*

Teachers are continually making decisions about how they teach. It is the teachers' experience and knowledge base which influences their course of action. Therefore, for teachers to implement any new pedagogical strategy they need to acquire new knowledge about it and then integrate this into the domains of the curriculum, classroom management along with existing pedagogical skills (Dexter et al., 1999). Cuban (1986) makes a telling observation; he comments that teachers were and still are the gatekeepers to what technology is used in the classroom because when they close their classroom doors they are in control of what happens (p. 66). Ertmer (2000) posits that the teacher's vision for or belief about classroom technology, let alone the beliefs about how children learn, do not always match their classroom practice.

In this study when the teachers were interviewed they spoke about the need for students to construct their knowledge through open ended tasks that included hands-on, collaborative learning opportunities and working in teams. However, when these teachers were observed in their daily classroom practices, many relied on textbooks and worksheet activities with students sitting in rows in deadly silence. Even when they were observed using technology the teacher either stood at the front of the class directing the lesson from an interactive whiteboard while students worked individually at their desks on a pen and paper activity. This was not a one off; the situation was repeated throughout the school across the days and weeks. Even though teachers may express the belief technology is best used for developing higher order thinking, the day to day application is mainly drill and practice or basic word processing because underneath they hold the core belief the teacher is responsible for what the student knows and does. This is evident in the response one participant gave when asked how you can best use technology to improve teaching and learning in your classroom:

> *I use it as often as I can in as many different ways possible. Technology is simply another tool in my classroom so that the students observe me using it all the time involved in technology as opposed to doing computers (Marlene, teacher - metropolitan school).*

From the data collected throughout this study it is evident many factors impede on the schools ability to integrate new technologies into their teaching and learning programs that will enhance and improve student outcomes. The researcher found some instances of teachers integrating new technologies into their teaching and learning and some principals, and other school leaders, who hold very positive views with regard to the importance of ICT in education. However, one feels this is very much dependent on each person's pedagogical stance rather than access to new technology affecting their pedagogy. The participants themselves supported this by stating that technology had not changed their practices.

> *In my approach to teaching I don't know if it's changed my pedagogy a lot but it has certainly improved the way that I can reach kids and engage them. However, I guess the thing that has changed my pedagogy through ICT is that because the children are often as good or better than me a using it and it has enabled me to really step up and change my views and attitude about the children leading the learning and having-not having to be the font of all wisdom, which it was when I went through as a student myself (Alison, teacher - L5 country school).*

> *Over the years I have moved away from traditional teaching pedagogies and more towards a student-centred and inquiry based approach. I integrate various strategies from six thinking hats, Blooms taxonomy, Multi intelligences and Habits of the mind. These strategies along with cooperative learning are well suited to the use of technology. I am what you would call an early adopter of the technology because before I switched to main stream teaching I was a Special needs teacher for ten years and technology became an integral part of the teaching repertoire to support these students in their learning (Janice, teacher, - outer metropolitan school).*

5.8.2 Professional Learning

Professional learning is vital to the overall development and up-skilling of teachers. The educational landscape is changing and educators need to stay in touch with the shifting emphasis on how children learn and what they need to construct knowledge that will support them in the future. It is widely recognised the students of today are facing an unknown future and need to learn skills and processes that develop

creativity, higher order thinking and reflection. To be able to deliver what the students' need requires a shift in the traditional content based education on offer today.

Research has shown that merely placing computers in classrooms does not guarantee use (Morehead & LaBeau, 2005). More PD is needed to address the lack of skills and competencies of existing educators' use of technology. This statement is supported by some of the typical comments made by participants in this study.

> *PD! PD! PD! and more PD on ICT programs/software and not just put on the shared drive and expected to use it. I need lessons modelled and then I have ago (a guide on the side approach). I need help in the classroom (Marie, teacher - L5 metropolitan school).*

> *All this technology is well and good. However, unless it is accompanied by teacher professional development aimed at equipping teachers with the skills and confidence to achieve the educational outcomes using technology it is effectively useless. There are too many schools that have been equipped with hardware, for example Interactive White-boards; but have not been able to access the training to get the most out of them. Many other schools who have achieved great things with the hardware have done so on the individual teacher's initiative and drive. It would be highly beneficial to see the Federal government support this professional development, but it is much easier at election time to point out a new building than at a teacher's new skills Kelly, beginning teacher - L4 rural school)*

> *I would like to become more confident through further PD and support from an ICT coordinator (Karris, teacher - L3 rural school).*

However, the findings from the survey indicated when it comes to professional learning only 15% of classroom teachers stated they used ICT online professional learning either frequently or often. Participants who state they sometimes, seldom or never use online professional learning represented 67% of the survey population.

This suggests teachers may still feel uncomfortable in using online professional learning forums and prefer face-to-face delivery.

In most schools in Western Australia, ICT is still largely peripheral to the classroom. The Western Australian Department of Education and Training (DET) has over the past twenty plus years attempted to foster the use of ICT in classrooms through a variety of projects such as 'Internet in the classroom', 'e2c', '100 schools', 'notebooks for teachers' and 'Partners in learning'. The latest programs - Partners in Learning is a partnership with Microsoft through the 'notebooks for teachers' program which offers teachers professional learning online. Unfortunately the majority of teachers have not seen or experienced how this program works or what it can offer, therefore have not taken up the initiative.

Table 6 (section 4.8) indicates that most participants in the teacher questionnaire have developed their skills and understandings of ICT applications through self-instruction. The professional learning opportunities for staff have mainly been in administrative areas such as SIS Curriculum Management and or reporting to parents. Time was one of the critical elements noted by teachers for not undertaking professional learning. They stated they needed time to plan, to play and to explore available resources before they felt comfortable and confident enough to integrate ICT into their teaching and learning.

> *I need more time to play, that's one of the problems we don't seem to have enough time to do anything and you can't go and do that in front of the kids as it is wasting their time… although sometimes it is good for the kids to see you problem-solve something, but you can't do it all the time though (Alison, teacher - L5 country school)*

> *At the school level unless you are selected to be part of a Department project there is very little support for developing your individual ICT skills. In most cases, if you want to develop your skills, knowledge and understandings of how to effectively use new technologies in your teaching and learning, you either access the PL yourself in your own time or tap into the PL offered on the DET portal. As I think technology*

> *is important and has a place in education I go out and seek my own professional learning opportunities, be they conferences, online learning, doing extra study and research or just 'playing around' at home trialling different programs (Sue, teacher - L6 metropolitan school).*

The findings from the survey indicated 64% of the respondents indicated leaders in their schools ensured staff were frequently if not often well equipped with the necessary skills in the use of ICT and 69% stated they have ICT reflected in their school plan for improvement.

In the author's opinion *Professional Learning* (PL) needs to have a clear focus on goals and outcomes. There needs to be purpose rather than a workshop for the sake of a workshop. The PL needs to focus on strategies for improving and refining pedagogy with an element of skills training. It ought to work through problems and find solutions while also improving teacher's knowledge and student learning outcomes (Ertmer, 2003). Therefore, PL must be relevant and immediately transferable to the school and classroom situation. Ideally it should provide time for teachers to practice and test new pedagogies and receive follow up support and coaching in their classrooms while they face problems implementing the change (Doherty, 2011).

If Australia is going to have 'technology rich learning environments that enable students to achieve higher quality learning outcomes and productively contribute to our society and economy' (MCEETYA, 2008 -2011) then there needs to be an investment in:

- *Leadership*
- *Infrastructure*
- *Learning resources, and*
- *Teacher capacity*

In this chapter the data from the questionnaires, interviews, and ethnographical narratives were discussed in relation to the research questions.

In the next and final chapter of this thesis is the conclusion. It presents a summary of the findings from this study and draws conclusions to systematically address the research questions. In addition, this chapter considers the limitations of this research and suggestions for further research are offered.

CHAPTER 6

CONCLUSION

6.1 Introduction

The previous chapter presented the discussion of the analysis of material collected in chapter 4.

The purpose of this study has been to evaluate the implementation of new technologies into teaching and learning in the primary school setting. The two main guiding questions for the research were:

1. Why use ICT in Western Australian Government primary schools?
2. What are the pedagogical justifications for investing in ICT in Western Australian Government primary school?

To do this a series of sub questions will be investigated using a theoretical framework that has been used for investigating Motor vehicle cash incidents. This model utilises three elements: The environment (System/schools), the driver (teachers/administrators) and the Vehicle (policies/applications and outcomes). The purpose of this model is to identify from within multiple factors the contribution of each of these factors and to the input that each may have to the end result. The Crash Investigation model was selected to arrange data from this study as it allows a clear organisation of several key factors as identified in the research questions. These are detailed below.

The environment (System/schools)

3. What support structures are required to encourage teachers to make pedagogical change for the successful implementation of ICT in the classroom?

4. What school cultures are most supportive of pedagogical change for the successful implementation of ICT in the classroom?

The driver (teachers/administrators)

5. What implications does teacher attitude play in successful implementation of ICT in the classroom?

6. What role does leadership play in the successful integration of ICT into the classroom?

The vehicle (policies/applications and outcomes)

7. What skills do teachers need in order to empower them to integrate ICT effectively in the classroom?

8. What role does professional learning play in the successful integration of ICT into the classroom?

This chapter presents the summary of the findings from this study and draws conclusions to systematically address the research questions. It also**,** considers the limitations of this research and suggestions for further research are offered.

6.2 Major Findings of the Study

In chapter 3 the researcher presented a conceptual framework based around the Crash Investigation model as a means of working though this study and conceptualising the data gathered. In this section each of the elements and the research question**s** related to this model will be presented as a way of summarising the outcomes of this study.

6.2.1 The environment (School/System)

This section addresses Research Questions 1, Why use ICT in primary schools?, Research Question 2 about the pedagogical justifications, Research Question 3 which looks at the support structures needed to encourage teachers to make change and Research Question 4, the school cultures that support pedagogical change.

The results of this unique study suggest that for new technologies (ICT) to be successfully integrated into the primary school system, in this case DoEWA, schools face the challenge of getting all teachers to use the appropriate technologies effectively in their everyday teaching. DoE has put many strategies in place, most of which involve developing a 'one stop shop' on the portal which has links to online resources through the learning federation, curriculum policies and documents, and online professional learning. Unfortunately, in today's climate, teachers are not accessing this resource to its full potential. The challenge for DoE and school leaders is how they can get staff to utilise this resource. Even though this research noted access as a barrier to teachers using ICT**,** the introduction of the 'Notebook for Teachers' (Nb4T) program which gave all practitioners who teach more than 0.1 on a 12 month contract access to the program.

Another barriers identified was time. Schools can budget for an allocation of more time for teachers to address ICTs, but in reality this is not always possible due to the limited resources available. Nevertheless, even when time is allocated and other barriers are minimised it still comes down to the attitude and belief of the individual teacher. If the teacher strongly believes in the benefits of technology then a way will be found to overcome the time barrier as evidenced by the teachers who do integrate new technologies into their teaching and learning appropriately.

So how do the system and or school overcome these obstacles that hinder technology integration. Research indicates central to the realisation of a digital school is all stakeholders must be proactive, have a vision for schooling in a networked world and implement a comprehensive, appropriately funded strategy that will assist in providing the desired outcomes (Lee & Winzenried, 2009, p. 216). However, even if the system has a proactive vision it is ultimately up to the school community to ensure they achieve total teacher and student usage.

One possible barrier could be there are too many security measures in place which discourages teachers from using technology in their classrooms. This is a dilemma

for the Department and the school since not enough security will leave students, teachers and school property unsafe. It is important that we achieve a balance.

Classroom technology is evolving rapidly and so must teachers' pedagogy in order to meet the learning needs of contemporary 'digital natives' (Murcia & Sheffield, 2010). It is essential we establish policies regarding professional learning that demonstrates new pedagogy**,** promotes technology integration and provide incentives to encourage teachers to engage in this type of professional learning. The Australian Government's 'Digital Revolution' acknowledges the changing needs and motivation of these students and aims to contribute sustainable and meaningful improvements to teaching and learning by preparing students for lifelong learning, to successfully contribute to and live in a digital world. DER strategic plan, (2008) acknowledged that Australian students need greater access to and more advanced use of ICT, as well as well-trained teachers who have the necessary expertise to integrate new technologies into their teaching and learning across the curriculum.

This study identified that the Department of Education in Western Australia has initiated many projects over the years to meet the needs of teachers to enable them to integrate new technologies into their teaching and learning. However, these initiatives have not always obtained the outcomes desired and have fallen short in making a sustainable difference at the grassroots level. The most common comment made by participants in this study was:

> *If it is going to be a priority then in needs to be funded appropriately and realistically (Jane, beginning teacher). This included funds for developing the teacher competencies and providing technical support (Julie, school leader).*

> *At present the rhetoric of ICT outweighs the reality. Teachers tend to do computers rather than integrate ICT (Bill, experienced teacher).*

> *Our school was involved in implementing the LwICT initiative and this was fantastic and it encouraged me to undertake activities and trial them in my classroom but one year on the project has been cancelled due to the teacher shortage and the school is left it its own devices. As a consequence teaches are left and no support is being offered to assist teachers who are not confident or lack the necessary skills (Karris, graduate teacher).*

These sentiments are not unique to this study. Other researchers (Ertmer, 1999; Devaney, 2009; Honey & Moeller, 1990; Kaestner, 2006) have found similar results. However, as can be noted through this research the Department, schools and the Federal government have invested in new technologies in education but mainly in the form of hardware and some online PD. In the researcher's opinion, which is supported by comments made by participants, it has fallen short in addressing the professional attitudes and beliefs of staff through adequate hands-on continual professional learning.

6.2.2. The Driver (Teacher/Leadership)

Following on from the environment this study reports the finding for the Driver. In this research the driver is classified as the teacher and or leader within the school context.

The research questions posed in this section were:

> Research Question 5: What implications does teacher attitude play in the successful integration of ICT in the primary school classroom?
>
> Research Question 6: What role does leadership play in the successful integration of ICT in the primary school?

The results of this study suggest teacher attitudes and belief about how children learn plays a major role in the successful and effective integration to teaching and learning with ICT

Those teachers who held a positive attitude indicated they felt ICT helped improve student outcomes with comments such as…

> *I am very lucky to be part of a school that adopts ICT as a priority as it goes hand in hand with inquiry based learning. I'll continue what I am doing as the results speak for themselves (Elyse, experienced teacher).*

Whilst teachers who held a more negative view stated:

> *It is virtually impossible for me to use technology in my classroom as I only have each group for 45 minutes (Miranda, graduate teacher).*

> *I need more Professional Learning run by humans rather than on-line (Marie, experienced teacher).*

> *There is no place for computers in Early-Childhood; this is a time for hand-on learning… kids can do the computer thing at home (Trudie, experience teacher).*

> *The rhetoric outweighs the reality…we need to be convinced that it will enhance learning ((Amanda, experience teacher).*

As stated in Ertmer (1999, p. 51) even if first order barriers were removed, teachers would not automatically use technology to achieve the outcomes desired. The second order barriers need to be addressed and by understanding this, especially in regards to teacher's attitude and belief, then educators may be in a better position to identify effective strategies for helping teachers address both the apparent first order and underlying second order barriers (Ertmer, 1999, p. 53).

Teachers must have time to develop, model and reflect on technology based learning pedagogies. They need to be given ample opportunities to engage in meaningful activities, collaborate with peers, exchange ideas, provide and receive feedback, reflect critically on their practices and engage in real world authentic activities that relates to technology integration (Vrasidas & Glass, 2005).

Overall, when combining the qualitative and quantitative data the participants were very positive in their attitudes towards teaching and learning with ICT as can be noted in chapter 4 as presented in table 14.

With regard to the role leadership plays in the successful integration of ICT in schools this study has indicated the majority of participant**s** believe leadership is a vital component in sustaining implementation and changing school culture**.** It is no different for ICT.

Strong leadership commitment to integrating ICT can help establish conditions and support for teachers to succeed. In the past, schools provided the knowledge. However, in the future schooling needs to be about developing the ability and judgements necessary to use knowledge critically. Some schools are facing this new responsibility; however the majority are not. The disruption and behaviours of students we see in schools today could stem from the fact students see school as being out of touch with their needs and the needs of the modern world (Papert, n.d)

For this element regarding leadership, there appears to be a difference between perception and reality. Teachers and leaders appear to talk the talk giving the perception they are on the same page. However**,** in reality there is little evidence they are walking the walk. This is an area that needs to be evaluated further. If schools are going to be t relevant in the future in meeting student needs then the way school functions will need to change and professional beliefs and attitudes addressed.

6.2.3 The Vehicle (Application/Outcomes)

The final aspect this research will report on is the vehicle which relates to the application of ICT. In this section the findings for the following research questions will be reported:

- Question 7: What skills do teachers need in order to empower them to integrate ICT effectively in the primary school classroom?
- Question 8: What role does professional learning play in the successful integration of ICT in the primary school classroom?

The results of this research suggest that to enable any initiative to be sustained there needs to be a commitment to effective professional learning and it needs to be sustained over time and not just a one of off-site course. However, to enable this to happen there needs to be a commitment from DoE to appropriately fund professional leaning (PL).

One of the major comments made by participants was in relation to the lack of PL, but not PL and software application but more to do with teaching and learning with new technologies and how to incorporate this into classrooms to obtain maximum impact.

To ensure technology is an integral part of teaching and learning, educators and policy makers need to address all elements and not just one or two. Technology should not be the driver of change, curriculum and pedagogy should be considered first then technology.

6.3 Implications of Study

Figure 26 is a diagrammatical representation of the elements needed for effective teaching and learning with new technologies in the primary school based on the view of the researcher after having explored the literature and data gathered in this study.

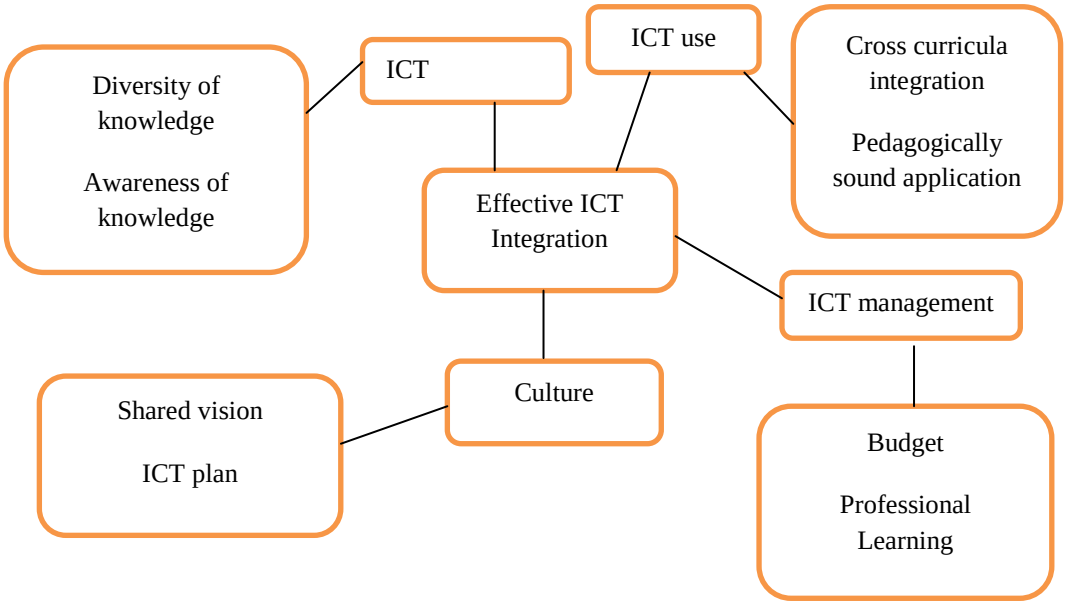

Figure 26: Model for effective ICT integration in primary schools

This research acknowledges the progress in the development of ICT in some primary schools across Western Australia. However, it also has identified a number of areas for improvement.

These are:

- further integration of ICT to support teaching and learning across the curriculum for all students;
- improving the breadth, balance and variety in the range of ICT experiences provided for the students including opportunities for them to use new technologies creatively and in problem solving activities;
- school leadership needs to have and support effective and clear strategies for the development of ICT across curriculum and to ensure all students have consistent ICT experiences;
- the system and or schools need to develop tools for assessment and recording of student's ICT achievement;
- the system (DoE) needs a strategic and coherent approach for the provision of technical and financial support to all schools across Western Australia;

- to develop effective and regular monitoring by schools and or DoE of student's progress and achievement in ICT.

6.3.1 Professional learning in ICT

Although DoE has, through the portal, online professional learning (PL) for teachers through 'Teachers have Class' it was identified by the participants as not always sufficient or desirable to ensure new technologies are embedded into practice. The age old issues of time and access were continually cited as reasons for not undertaking or accessing this professional learning (PL).

Teachers and administrators need to be challenged in regards to their beliefs/ideas on how new technologies can be used to enhance teaching and learning in the classroom and improve student outcomes.

The analysis of data in this research indicated that in most cases teachers:

- had their students accessing ICT at school for minimal periods of time and in most cases less than one hour per week;
- had students use ICT at school for accessing and presenting information with little thought and application to analysis and synthesis;
- found their students' ICT skills were narrow and usually determined by what they do at home or the capabilities of the teacher's skill level;
- used ICT as a peripheral to the main learning activity and was mainly used as a reward for early finishers.

6.3.2 ICT and the curriculum

The Australian National Curriculum and the Digital Revolution can provide opportunities for the effective integration of new technologies into teaching and learning, however there are critical incompatibilities between the direction of schools and the needs of most students to live and work in today's and future societies. Also, what is known about how children learn and the integration of new technologies to

support that learning and the direction of schooling in Australia is back to the past, creating schools we once knew (Newhouse, 2010).

In researching this topic the researcher found many teachers were less inclined to focus on or attempt to integrate new technologies into their teaching and learning because they felt pressured by the external authorities to achieve high standards in the NAPLAN (National Assessment Program – Literacy and Numeracy). However, the Australian National Curriculum is founded in the Melbourne Declaration of Educational Goals for Young Australians (2008) which cites:

> *Supporting all young Australians to become successful learners, confident and creative individuals and active and informed citizen and to promoting equity and excellence in education (MCEETYA, 2008b)*

Newhouse (2010) purports the narrow focus on literacy and numeracy has not helped instruction centred strategies, as it is disconnected from students' lives and is not perceived to be interesting and fun. Therefore, as a result a number of students, in particular boys, are becoming disengaged from learning at school.

This research has noted the mismatch between teacher beliefs and what the plethora of research is telling us. Therefore, it is no wonder teachers and school leaders are confused about the direction of education in today's society when the messages from the policy makers and government leaders are conflicting and misleading.

6.3.3 Teacher attitudes and beliefs about ICT and teaching and learning

It is concluded by the researcher that beliefs about the nature of learning plays a major part in the overall use of new technologies in teaching and learning since poorly informed beliefs about schools and learning along with inadequate leadership to support ICT implementation are major constraints to integrating ICT into teaching and learning.

Finally, to date, ICT use has been implemented inadequately and half heartily in Western Australian schools. If society is going to see a change to a situation where schools are delivering relevant knowledge and skills to enable students to live and work in an ever changing world, then educators need to engage in the integration of new technologies into teaching and learning.

6:4 Limitation of the Study

Even though a mixed method approach was considered the most suitable to this study there are many traditional prejudices against ethnographical mixed method research (Yin, 2009). According to Yin (2009) one of the greatest concerns is the lack of rigor and the fact it provides little basis for scientific generalisation. Another prejudice against ethnographic research is the amount of time involved and the gathering of massive, unreadable documents and the fact narrative inquiries do not lend themselves well to replicability and are not generalizable (Yin, 2009). Nevertheless, it takes time to build trust with participants that facilitates full and honest self-representation. Short term observational studies are at a particular disadvantage where trust building is concerned. Furthermore, any group that is studied is altered to some degree by the very presence of the researcher. Therefore, any data collected is somewhat skewed (Yin, 2009; Punch, 2009).

Qualitative research is neither prescriptive nor definite. While it provides significant data about groups or cultures and prompts new research questions, narrative studies do not attempt to answer questions, nor are they predictive of future behaviours. Therefore, along with the traditional prejudices against ethnographical research is the issue of bias. According to Trochim (2006) research needs to be free from bias and needs to be objective. However, Cohen et al. (2003) states one of the advantages of an ethnographical approach enables the researcher and reader to gain an insight through the analysis of social episodes. Nevertheless, researcher bias stemming from personal views on this research was identified as possible problem and this was a consideration in designing the research. As a result it was decided that use of auto-ethnographic approach would be undertaken to allow the bias to be separated out.

Consequently, it was regarded as an acceptable limitation since the motivation component was a necessary element for this research to be completed.

Another limitation in using a mixed method approach, namely interviews, is the fact that there may be further possibilities for error due to misunderstanding and communication problems. Due to the varied nature of the responses, it is necessary to use the content analysis technique to analyse responses and this can be considered time consuming. Open questions used in this semi-structured interview approach can cause confusion either because of the lack of understanding of the question by the informant or by the lack of understanding of the respondent's answer by the interviewer. Efforts to eliminate these sources of error were considered through the use of a questionnaire pilot and participant cross-checking. The interviews were conducted in a friendly atmosphere, the researcher attempted to remain non-judgemental.

A major limitation of this research relates to the small number of participants in each area of data collection. While every attempt was made by the researcher to improve this rate, it was beyond her control. It should be noted that any generalisation from the data of the study should take this into account.

In examining the limitations of this study it is acknowledged the sample size comprised of only 169 primary teachers and 98 leadership responses. Although remote, rural/country and metropolitan primary schools were represented in the study, the participation rates were very disappointing despite repeated efforts to improve this. This however, in an in-depth case study approach, is not a limiting factor but a desirable one as more time can be spent with each participant and a deeper level of data collection can be undertaken with each participant.

6.5 Future Research

As a result of this research a number of areas of potential interest for further investigation have come to light. In particular there are matters of generalisation, verification and greater discrimination to be explored.

This study could be extended to explore the ease and access to current ICT resources and whether this is a factor as to why technologies are not fully utilised by classroom teachers.

Major barriers identified in this study were the lack of access to up-to-date fully functioning equipment and technical support. There could be an investigation using a series of case studies of schools where technical support is assigned to a school or cluster of schools to see if this makes a difference to the adoption of technologies into teaching and learning.

Further research could investigate whether schooling today adequately prepares students for living and working in a changing world?

This study found most participants still struggle with adopting and using technology to its full potential when it comes to educating the 21st Century child.

More research is needed into the future implications of technologies in curriculum reform and are we (educators and or parents) happy with the current level of learning opportunities provided for all students especially related to learning with new technologies?

The importance the pedagogical change needed to make technologies an integral part of the teaching and learning process was identified as a key issue in this study.

Investigate what is needed to change the beliefs and attitudes of teachers and school leaders about the potential benefits of integrating new technologies in teaching and learning?

6.6 Recommendations

As an outcome of this study, and the researcher's personal experience, their needs to be more emphasis placed on addressing teacher attitude and belief about best practice and pedagogy in relation to how students' learn. Further investment needs to be targeted towards addressing this and not just in providing the hardware and software needed to integrate ICT into teaching and learning.

The Education Department needs to invest in providing primary schools with fully funded qualified technical support, so as to enable schools to operate their networks efficiently and to release teachers to get on with their core business which is to teach and support student learning.

Secondl**y,** the Department needs to invest in and provide fully funded professional technical support to primary schools to eliminate one of the major inhibitors to ICT integration into teaching and learning as was reported by teachers and leadership.

Another recommendation is for universities to target teacher attitude, pedagogy and technology in a more strategic and comprehensive way by interweaving ITC throughout the 4 Year training of pre-service teachers rather than limiting ITC to the first year of a teacher's training.

6.7 Conclusion

In setting the context for teaching and learning with ICT in Western Australia, and planning a way forward, this thesis has explored the historical development of

technology in education, explored issues for schools mainly from a curriculum implementation perspective, examined current initiatives along with overseas and national perspectives and has considered research evidence for developing quality ICT programs with a view to identifying how the state education system can further support schools and teachers develop more evidence based programs which deliver better outcomes for students in WA schools.

It is the researcher's view that with the vast investment already made by governments into ICT, any future outlay must be strategic and affordable. The programs and initiatives put in place should be directed toward supporting teaching and learning that will enhance and improve students' life and employment opportunities. Since computer related technology is common place in society today, having impacted on classrooms across the world (Dunlap, 2002; November, 2010; Vrasidas & Kyriakou, 2008).

Dunlap (2002) stated "technology is there, waiting to be used; however few teachers may know what to do with it all. While these schools have worked hard to bring the technology to classrooms, many may not have made the extra effort needed to bring the teachers to the technology". In Western Australia, there has been an increasing emphasis on teaching and learning with information communication technology (ICT) since the late nineties. However this study has found teachers may not have the confidence or the competencies to take this integration of new technologies beyond the basic skills. As a consequence, this researcher is still waiting to see ICT take hold through effective teaching and learning practices of the majority of teachers.

Vrasidas & Kyriakou (2008) in their study concluded that 'the integration of technology in education has been a focus for many educational systems over the years and teachers' beliefs and attitudes, the school culture, curriculum and pedagogy are the major inhibitors to the successful integration of ICT in teaching and learning. The evidence in this study supports the conclusions made by Vrasidas and Kyriakou.

Research (Cubin. 1993; Cubin 2001; Farrell, 2003; Government of WA, 2003) has indicated education systems around the world are injecting large financial resources into providing technologies in schools but providing technical hardware is not enough. There needs to be co-ordinated approach with a strong vision by all stakeholders that is supported by system/school leaders, teachers and parents. Smeets (2005) also concludes that teaching and learning needs to be delivered in a powerful learning environment presenting students with a rich context using co-operative learning through differentiated curriculum that meets individual student's needs. This research indicates that teachers use computers mainly to complement rather than change current pedagogical practices; however this not being effectively and therefore could be improved upon across many areas.

In order to exploit technologies in education, teachers need to be convinced about the potential of ICT to contribute to the enhancement of the learning environment, to motivate student activity and develop independent learning. To support teachers and to get them to change their attitudes and beliefs about how students learn and the role technology can play, teachers need to:

- Believe that technology can enhance their teaching and learning and improve student outcomes;
- Feel comfortable using technologies;
- Be able to integrate technology appropriately and wisely into their teaching and learning;
- Have ICT readily available;
- Have support and the tools available to assist, when required, in the management and administration of the class.

For the successful integration of ICT into teaching and learning this study suggests teachers and administrators must have time to develop and reflect on technology based pedagogy, they must be given time and opportunities to engage in meaningful professional learning that not only looks at the technical aspects but also new pedagogy and best practice. Professional learning needs be continuous and include

meaningful activities that encourages and fosters collaboration, sharing and exchanging of ideas with peer feedback to enable teachers to continually reflect on their practices and engage in real world authentic activities that are related to ICT integration (Vrasidas & Kyriakou, 2008). As educators we need to rethink the philosophical and pedagogical assumptions of education however, to change school culture requires time, effort and strong political will (Vrasidas & Kyriakou, 2008).

Our role as contemporary educators is to ensure learning environments are reflective of the student's real world. Therefore, as an educator, it is vital to promote the use of ICT as the effective tool to deliver relevant and engaging teaching and learning to students in the classroom. However, it is not to be used to the detriment of other teaching and learning pedagogy because it is not the technology that makes a difference it is how the teacher uses it that impacts on the learning outcomes. Therefore, teachers need to know when and how to use the technology effectively and students need to know and understand how this technology can offer a more individualised program to enhance learning.

As research regularly attests, the most important factor by far in improving student outcomes is the teacher not the technology (Lee & Winzenried, 2009, p.226). From classroom observations it was clear students enjoyed using ICT. For many the opportunity to learn through interacting with technology enabled them to demonstrate knowledge and understanding in a fun and motivated way. This was especially evident in those classes where the teacher was using an inquiry approach to teaching and learning. In some schools, it was noteworthy to see how boys demonstrated first-hand how they were mastering English outcomes, in particular, the skills acquired by participating in authentic learning opportunities using multimedia technologies. The technologies seem to provide the students with a safe environment to explore learning processes without the fear of ridicule. The visual nature of the technology had captured their interest and motivated them into expanding on and demonstrating their learning.

As one participant said " change is happening and teachers need to recognise the power of ICT because kids expect it" and Newhouse (personal communication 23 February 2005) commented that "recent research suggests that teacher belief about teaching and learning pedagogy influences the implementation of ICT in schools more than anything else". However from the conversations and data gathered, it seems that leadership within the school also plays an important part, because without a strong leadership that has the vision and belief about teaching and learning pedagogy and the power of new technologies to enhance student outcomes, nothing will happen.

Baylor and Richie (2002) advocate schools that have a comprehensive technology plan are the most successful in integrating new technologies into the curriculum. In addition, they cite leadership of the school as vital to the successful integration of new technologies into teaching and learning, emphasising the need for school leaders to 'join in' rather than 'sit on the side' when it comes to nurturing new technologies in education.

This study concludes that the teachers who participated in this study in Western Australian government schools are using technology in their teaching and learning for lower level applications such as creating worksheets. They are not using it for higher order applications such as online learning which caters for differentiating the curriculum to meet individual needs. Therefore, in the context of this research, while teaching and learning with ICT in government primary schools is beginning to happen, some schools are further advanced than other schools in the integration of new technologies. The reason for this requires further investigation on a larger scale perhaps, longitudinally.

Overall education has a long way to go in changing its teaching and learning culture and being relevant to the needs of students today and in the future. The investment into new technologies has begun, however from the researcher's knowledge and understanding of the issue the reality is even though the government has made a huge

investment of tax payers' money into providing the hardware, connectivity and, to some degree, professional learning opportunities so that schools can upgrade resources and up-skill teachers' competencies have largely gone unchecked.

There is a tendency under the current political climate to forget about educating students for the future but to replicate tradition by concentrating heavily on the results of national testing and in what some say is 'dumbing down' our nation.

> *PRIME Minister Kevin Rudd made much of his education revolution over the past 12 months, promising to address the digital divide he claims is affecting the performance of students. Yet the disturbing evidence that has emerged from the latest results of the OECD Program for International Student Assessment is not of socio-economic inequity. Rather, it shows Australian schools are dumbing down their high achievers, particularly girls (The Australian, 2007).*

This study investigated the status of teaching and learning with ICT in Western Australian primary schools. In doing so this thesis has identified extrinsic and intrinsic elements which impede the integration of new technologies in primary classrooms. Many of the extrinsic elements, such as access and resources, have been addressed through various strategies implemented at the local, state and federal level. However, the intrinsic elements of teacher's or teachers' beliefs and attitudes with regard to 21st Century teaching and learning pedagogy are still critical.

From the researcher's experience of working in a variety of schools across Western Australia, it has been observed teachers young or old, experienced or inexperienced (on the whole) appear to have the same mind set of education, in particular what school**s,** should look, sound and feel like. When discussions are held with staff they all appear to talk the talk about how people learn and what needs to happen. Educators also agree the way they were taught did not always meet their needs. Nevertheless, it is evident when you work with these same people they do not walk the walk. In the majority of cases time is quoted as the biggest obstacle for making change. Even having worked with pre-service teachers the attitudes and beliefs

amongst them is similar to post service teachers and while pre-service teachers start out in their course as enthusiastic trail blazers when they hit the schools often they soon adopt the practices of their mentor teacher.

It must be noted that many pre-service teachers who enter our system are mature age and in many cases have limited or no experience in teaching and learning with new technologies other than the one semester course offered in their first year of training. This course offered at the university is basically centred on gaining ICT skills and not the whole technology, pedagogy and content knowledge model, which in the researcher's view is important.

To address the overall issue of integrating new technologies in teaching and learning to enhance and improve student outcomes there needs to be further investigation. In many respects governments concentrate on tangible elements of new technology in education rather than the intrinsic elements because it is much easier to justify to the critics. When it comes to developing ICT competencies for teachers, today's classroom teachers must be prepared to provide technology related, supported learning opportunities to students. Being prepared to use technology and knowing how that technology can support student learning must become integral to the skills and knowledge of every teacher's professional repertoire. It is the professional responsibility of educators to empower students with the advantages that technology can bring. Traditional educational practice does not provide prospective teachers with all the necessary skills for teaching students, who will need to be able to survive economically in today's workplace. Teachers who teach students to apply strategies for solving problems and to use appropriate tools for learning, collaborating and communicating are.

The problem is not, in this researchers view, necessarily the lack of funds but the lack of effective training and understanding of how ICT can be used to enrich learning experiences, a view that is also supported by others as evidenced through the plethora of research literature (Global Alliance for ICT Development, 2011).

To improve this situation we as educators need to step back and reassess our core business which is the education of the students in our care. Our role is to support and enable students to engage in and become lifelong learners in a learning environment that is stimulating and motivating. After all teaching is about the students and without them we do not have a job.

In the words of Davis, Dennis and Luce-Kapler (2000):

> *"Learning can never be determined by the teacher. However, that path of learning is dependent upon the teachers – along with a host of other contingencies".*

Overall this study has provided the researcher with an insight and understanding of the state of play in regards to teaching and learning with ICT in Western Australian Primary Schools. It has given her the confidence to apply for and be invited to be part of a working group looking at the new graduate teaching standards with reference to ICT. This 'teaching teachers' forum is a joint venture between the Australian Council of Computers in Education and the Australian Institute for Teaching School Leadership.

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Appendix A –Leadership Survey

Leadership Survey

To answer the following questions, please tick the box that best matches your response and write a response in the space provided.

Q1. Which of the following best describes your role?

Principal ☐

Associate Principal (Deputy) ☐

ICT coordinator ☐

Level 3 Teacher ☐

Q2. As leader do you have a teaching role?

Yes ☐

No ☐

Q3. What is your gender?

Male ☐

Female ☐

Q4. What is the classification of your school?

Level 6 ☐

Level 5 ☐

Level 4 ☐

Level 3 ☐

Q5. In what region is your school located?

Metropolitan ☐

Large country town ☐

Rural ☐

Remote ☐

Q6. Has your school been or is your school now part of any special ICT program

LwICT (100 Schools ☐

SLICT ☐

Schools Online learning ☐

Other, please specify _____ ☐

No ☐

Q7. Using ICT in learning and Teaching

Please indicate in your opinion how important it is for your school to

	very important	important	neutral	slightly important	not important
a) have a clear vision of its ICT integration strategies, and this vision must be shared by all members of the school community.					
b) have an ICT plan that considers issues of staff and student development of ICT skills, curriculum and assessment.					
c) provide effective opportunities for all students to acquire an appropriate range of ICT skills.					
d) provide curriculum programs that ensure the progressive and coherent development if ICT skills.					
e) audit the impacts made by specific curriculum areas to the overall development of students' ICT skills, including regular opportunities to practise them.					

Q8. Support and guidance for teachers

In your opinion how important is it that

	very important	important	neutral	slightly important	not important
a) school leaders lead the way by improving their own ICT competencies through the attendance of staff development with classroom teachers, using ICT in their daily administration and communication tasks.					
b) school policies encourage and support the uptake of ICT by teachers by allowing teachers time to experiment with new teaching methods using ICT.					
c) school leaders employ strategies to provide their teachers with the support to integrate ICT into their school curriculum.					
d) the appointment of an ICT coordinator provides the administrative an pedagogical support for the teachers					
e) programs have a clear framework for the systematic teaching of specific ICT skills relevant to their learning.					
f) all students have regular opportunities to practice and use the specific ICT skills relevant to their learning.					
g) ICT skills link to and draw from a range of curriculum areas.					
h) good advice is provided to staff on developing student's ICT skills					
i) programs take account of students' prior skill levels and encourage continuity and progression across the primary school.					

Q9. The teaching process

In your view how important is it that

	very important	important	neutral	slightly important	not important
a) in order to optimise the potential of ICT, there should be a shift in pedagogies, redesign of the curriculum and assessment.					
b) ICT should be integrated into school's plan to meet the curricula goals.					
c) when ICT is perceived by teachers as tools to meet curricula goals they are more likely to integrate into their lessons.					
d)when ICT is employed in the learning environment, there will be a shift in teaching and learning strategies					
e) teachers use appropriate blends of approaches, which include the use of ICT, where appropriate.					
f) ICT resources are well organised so that both teachers and students have access?					
g) teachers are aware and make use of appropriate safe user protocols, including protocols for access to the Internet.					

h) teachers can access immediate and effective technical support so that the flow of learning and teaching can be maintained when problems with ICT occur.					
i) teachers engage students in challenging and stimulating discussion about their use of ICT to ensure that their skills are developing to their maximum potential.					

Q10. Pupils' learning experience

Please indicate the extent to which each of the following statement relates to your belief about ICT in your school.

	extremely likely	likely	not sure	unlikely	extremely unlikely
a) The use of ICT stimulates students and increases their motivation in the curriculum area.					
b) The use of ICT increased the pace of learning for individuals and groups of students.					
c) Students are responsive and self-confident when offered opportunities to use ICT independently, or in groups.					
d) Students are good at helping each other to develop skills in ICT.					
e) ICT use is effective in making students independent and collaborative learners.					

Q11. Meeting students' needs

In your opinion…

	frequently	often	sometimes	seldom	never
a) The use of ICT reduces barriers to learning for individuals and groups of students.					
b) The school supports students who have limited access to ICT out of school.					
c) The use of ICT helps individual students to build their ICT skills, including those required outside of school and work at an appropriate pace and / or level.					
d) The school uses ICT to help teachers and students to identify specific learning needs and set individual targets.					
e) Students have access to ICT facilities which have been adapted were necessary and matched effectively to their specific needs.					

Q12. Staff review and development

In your opinion…

	frequently	often	sometimes	seldom	never
a) Leaders ensure all staff is equipped with the necessary skills in the use of ICT, thus demonstrating their commitment.					
b) The commitment to the use of ICT is reflected in the school's plans for improvement and staff development program.					
c) The staff review involves active consideration of the needs of each member of staff in relation to ICT.					
d) Staff development focuses on developing an effective blend of learning and teaching pedagogy which includes the use of ICT as appropriate.					
e) Teachers are aware of current resources and best practice in the use of ICT to support learning.					
f) The school is making best use of the expertise of its own staff as well as local and national expertise in sharing and developing best practice.					

Q13. Professional Knowledge

I understand that ICT can be used to

	strongly agree	agree	neutral	disagree	strongly disagree
a) benefit teaching and learning and is most effective when used in the context of learning and not as an end in itself.					
b) support and enhance what students learn, how they learn, and when and where their learning takes place.					
c) transform what students learn, how they learn and when and where their learning takes place.					

Q14. Professional Learning.

In your opinion…

	strongly agree	agree	neutral	disagree	strongly disagree
a) ICT professional development programs should focus on both pedagogical and technological aspects of ICT integration.					
b) just-in-time learning should be an integral part of the professional development of teachers.					
c) continual professional development of teachers should be an entitlement for them.					
d) the ICT professional development program for teachers should be planned based on the vision of ICT					
e) there should be a recognition system for innovative and effective use of ICT integration in schools.					

Thank you for taking the time to complete this survey.

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Appendix B - Teacher questionnaire

Teacher Questionnaire–

Please answer the following questions, ticking the box that best matches your response and write a response in the space provided.

Q1. Which of the following best describes your role?

Principal ☐

Associate Principal (Deputy) ☐

Teacher ☐

Specialist ☐

Education Support Teacher ☐

Other, (please specify) _____ ☐

Q2. What is the level of your school?

Level 6 ☐

Level 5 ☐

Level 4 ☐

Level 3 ☐

Q3. What is your gender?

Male ☐

Female ☐

Q4. In which age group do you belong?

Less than 24 ☐

25-29 ☐

30-39 ☐

40-49 ☐

50-59 ☐

60+ ☐

Q5. What is your employment status?

Permanent ☐

Permanent on probation ☐

Fixed term ☐

Casual ☐

Q6. What is your mode of employment?

Full –time ☐

Part- time ☐

Job –share ☐

Other, please specify _____ ☐

Q7. How many years have you been working schools in the WA Government system?

0 – 1 year ☐

2 – 3 years ☐

4 – 5 years ☐

6 – 9 years ☐

10 – 19 years ☐

20 years or more ☐

Q8. In what region is your school located?

Metropolitan ☐

Large country town ☐

Rural ☐

Remote ☐

Q9. School Capacity

Please indicate which of the ICT resources listed below are <u>available</u> for use at school as a teacher and whether you have <u>used</u> them.

ICT resources	**Is it available?** Yes	No	**Don't know**	**Have you used it?** Yes	No
a) desktop/laptop computer for personal use					
b) notebook for teacher program					
c) SIS Curriculum management					
d) personal email account					
e) school Intranet					
e) Internet					
f) printer					
g) digital cameras					
h) specialist software applications (CAD, HTML editors)					
i) technical support					
j) data projectors					
k) desktop computers for students					
l) laptop computers for students					
m) interactive whiteboards/mimio/tablets					

Q10. Access to professional Development

Please indicate whether you have <u>undertaken</u> professional learning in any of the ICT areas listed below. (Professional learning can be either group presentations/individual one on one/ or self-learning)

If so, please indicate whether the professional learning was arranged <u>through your school</u> and if you found it <u>effective</u> in helping you integrate ICT into your teaching and learning program.

	Have you undertaken it?			**Was it arranged through the school?**			**Was it effective?**		
	Yes	**No**	**self-taught**	**Yes**	**No**	**don't know**	**Yes**	**No**	**don't know**
a) Training in the use of computers/basic computing									
b) SIS Curriculum Manager									
c) Word processing (MS Word)									
d) Spread-sheets (Excel)									
e) Presentation software (Power-point, Producer)									
f) Databases (Access)									
g) Publishing (Publisher)									
h) Movie making (Photo-story, MS-Movie maker)									
i) Web searching (Internet)									
j) Email (Web-mail, Outlook)									
k) Thinking tools (Kidspiration/Inspiration)									
l) Training on how to integrate technology within the curriculum – workshops, online tutorials, pdpoint									
m) Digital cameras									
n) Interactive Whiteboards, mimeo, e-beam									

Q11. School planning and leadership

Please indicate the extent to which you agree or disagree with each statement use of ICT at school.

	strongly agree	agree	neutral	disagree	strongly disagree
a) My school has a clear sense of direction in how to use ICT to enhance the learning of students.					
b) My school encourages the use of ICT by all teachers and puts support strategies in place for everyone.					
c) The use of ICT is encouraged in the teaching and learning of students at my school and appropriate access and support is provided.					
d) Teachers at my school are encouraged and supported in participating in professional ICT learning opportunities.					
e) ICT is used to monitor, evaluate and report on student achievement at my school					
f) Sufficient IT resources are available to meet the ICT requirements of teachers and students.					

Q12. Attitude toward ICT

Please indicate the extent to which you agree or disagree with each statement about ICT.

	strongly agree	agree	neutral	disagree	strongly disagree
a) ICT has no place in primary school teaching and learning programs.					
b) ICT provides primary teachers with suitable backup and extension material for students, indicating a still strong perception of ICT as an "add-on" or reward rather than integral to their core teaching.					
c) ICT is "time consuming" or presents teachers with difficulties related to shortage of hardware and or software and faults in equipment.					
d) ICT in the primary school is still an additional component rather than an integral element in the delivery of the curriculum.					
e) The integration of ICT within the curriculum is a goal. However, there is still a tendency to focus on **'teaching ICT'** rather than **'teaching with ICT'**.					
f) Student use of ICT has the capacity to strongly support student-centred, inquiry based learning.					
g) ICT provides valuable resources and tools to support student learning					
h) ICT has limited capacity to provide benefits in the classroom					
i) I like the challenge of exploring technology and new software and its possibilities.					
j) ICT is useful resource in supporting my teaching and learning program					
k) The use of ICT in the teaching and learning program can empower all students					

Q.13 Beliefs about ICT integration into teaching and learning

Please indicate the extent to which you agree or disagree with each of the following statements.

a) Teachers are becoming increasingly aware of ICT; some have attended training, but often lack the confidence and as a consequence of this are therefore reluctant to use it in their classroom teaching and learning program.					
b) Teachers are increasingly aware of the benefits of technology and beginning to incorporate it into teaching often replacing former activities with ICT alternatives, as a consequence of this is having a beneficial effect on teaching and learning outcomes.					
c) Teachers are becoming increasing familiar with appropriate use of ICT and can integrate it into many aspects of their ongoing teaching; as a consequence of this Teaching and Learning are becoming significantly enhanced.					
d) The potential of ICT is now exploited to enable approaches which could not be easily replicated by traditional means as a consequence of this Teaching and Learning begins to be significantly transformed.					
e) In primary schools, without a dedicated computing department, many teachers feel that they must focus on the development of pupils' ICT skills before they can gain maximum benefit from the resources.					

Q. 14 Integrating ICT into Teaching and Learning

Please indicate the extent to which you have students:

Q15. School capacity to support ICT integration

Please indicate your position on each of the following in relation to the school support for ICT integration

	yes	**no**	**don't know**
a) Is your school's capacity to provide integration hindered by a shortage or inadequacy of computers for instruction?			
b) Is your school's capacity to provide integration hindered by a shortage or inadequacy of computer software for instruction?			
c) Is your school's capacity to provide integration hindered by a shortage or inadequacy of audio-visual resources for instruction?			
d) Is ICT a priority in your school?			
e) Is ICT part of your teaching and learning?			
f) Do you make ICT an integrated part of your teaching and learning?			
g) Is there a school budget for the implementation of the ICT in the school plan?			
h) Do you feel confident in integrating ICT into your teaching and learning?			

Q16. Application of ICT in the classroom

Below is a list of statements about the extent to which you apply ICT within your teaching practice. Please choose the one description that best describes your situation.

	frequently	often	sometimes	seldom	never
a) compare materials presented in different media?					
b) read stories or other texts on the computer?					
c) use the computer to write stories or other texts?					
d) use the computer to communicate with or do projects with students in other schools or countries?					
e) watch movies, videos, or television to obtain information?					
f) read instruction and/or do reading activities, on the Internet					
g) read instruction and/or do reading using computer software					
h) use computer technology to find information?					
i) play games on the computer?					
j) use a computer at school?					

In my current teaching, ICT is:

a) having an extensive impact on what students learn and how they learn	
b) a useful resource impacting on some areas of the curriculum	
c) improving student skills in the use of ICT	
d) having little impact on student learning	
e) not applicable to my role	

Q17. Learning, Teaching and the Curriculum

Please indicate the current situation in your teaching context.

In my class, students use ICT to…

	frequently	often	sometimes	seldom	never
a) engage in independent learning through access to education at a time, place and pace of their own choosing.					
b) provide motivation for curriculum task.					
c) develop deep understanding about a topic of interest relevant to the curriculum areas/s being studied.					
d) acquire awareness of the global implications of ICT based technologies on society					
e) engage in sustained involvement in long-term projects					
f) undertake formative and /or summative assessment – develop a personal digital portfolio					

Q18. Achieving Outcomes

Please indicate how often you incorporate student use of ICT to achieve the following learning outcomes.

	frequently	often	sometimes	seldom	never
a) demonstrate what they have learned					
b) remediation of skills not learned well					
c) actively construct knowledge that integrates curriculum areas					
d) communicating with others using electronic modes – emails/discussion forums					
e) developing an understanding of the world by finding out about ideas and information					
f) analysing information					
g) presenting information to an audience					
h) acquiring knowledge, skills and attitudes to deal with ongoing technological change					
i) learning to work collaboratively					

Q19. Assessing student outcomes using ICT

Please estimate how often you use the listed ICT activities when assessing student outcomes.

	frequently	often	sometimes	seldom	never
a) Student assignments that incorporate a learning experience involving the use of an ICT application					
b) Digital artefacts, from student assessments, as evidence towards student achievement					
c) ICT programs, material and applications that enable assessments to be customised towards specific learning needs					
d) SIS Curriculum Manager to monitor, evaluate and report on student achievement					
e) Other ICT applications to monitor, evaluate and report on student achievement					

Q20. Personal/Professional use of ICT

Please estimate how often you use ICT to achieve the listed personal/professional outcomes.

	frequently	often	sometimes	seldom	never
a) Create materials for students use (handouts, worksheets, tests)					
b) Assess research and best practices for teaching					
c) Curriculum administration (planning, monitoring, evaluating, reporting)					
d) Communicate with colleagues/other professionals					
e) Communicate with student(s) and/or parents					
f) Post information to a website to assist your students in their work					
g) Online professional learning (pdpoint, Teachers Intouch,)					

Q21. Professional knowledge

	Yes	**No**
I understand how ICT can be used to support and enhance what students learn, how they learn, and when and where their learning takes place		

Q22. Professional Practice

	Frequently	Often	Occasionally	Rarely	Never
I plan learning experiences within units of work that use ICT to achieve curriculum goals and are based on student developmental needs, interests, prior knowledge and experiences					
I provide opportunities for students to use ICT to enhance the learning of concepts and processes, working independently and as part of a group					
I provide challenging tasks that integrate learning areas and involve student ICT use throughout all stages of the learning process and for a range of purposes					
I create opportunities for students to use ICT to develop and apply new knowledge, skills and understanding					
I effectively manage the access to and use of ICT resources in meeting learner needs					
I provide opportunities for students to purposefully use a range of communication tools in their learning; and to participate with others in ICT projects in local, national or global communities					

Q23. Professional Values

	Frequently	Often	Occasionally	Rarely	Never
I set my own ICT learning goals based on regular reflection of my own professional practice and determined needs					
I am committed to developing my skills, knowledge and abilities required to exploit the potential of ICT in education					
I critically review and select from ICT resources and teaching and learning approaches and adapt where necessary					
I operate safely, legally and ethically when using ICT and teach and model this practice for students					

Q24. Professional Relationships

	Frequently	Often	Occasionally	Rarely	Never
I seek opportunities to contribute to professional teams to share what I know and do regarding ICT and pedagogy					

Q25. How can you best use technology to improve teaching and learning in your classroom?

_____

_____

_____

_____

_____
_____
_____
_____

Q26. Please describe any factors that would need to change to enable your use of ICT in the classroom?

_____
_____
_____
_____
_____
_____

General comments

Please feel free to make any further comments regarding the integration of ICT into Teaching and Learning.

_____
_____
_____
_____

Thank you for taking the time to complete this survey.

Appendix C - Interview questions

Interview questions

These questions were used to guide the discussions with teachers.

- What is your school context? – level, number of staff, number of computers, computer deployment
- How would you describe your general approach to teaching and learning? Where does technology fit into this view? Is your approach to teaching and learning similar to or different than other teachers in the school, and in what way(s)?
- On average how often do you use ICT in your Classroom each week? How important is it to integrate ICT into your teaching and learning? Which teaching tools/resources do you use regularly? ie computer, Smart-board, digital camera
- How has your approach to teaching pedagogy and your role in the classroom changed through your ICT journey? (example interaction with students, new instructional methods, classroom management strategies) How much do you integrate ICT into your pedagogy?
- How is your school integrating ICTs into curriculum and pedagogy? What are its most positive/negative aspects and impacts? What kind of technical support is there available in your school? Is it adequate for your teaching needs?
- How are students using technology? How do you provide/create opportunities for student to use ICT to enhance the learning of concepts and processes to develop and apply new knowledge, skills and understanding? Please be specific (produce original work, use tutorials, simulations, or drill and practice software etc). How do you use technology as part of the innovation?
- Is the innovation helping your students to develop (new) knowledge/skills/attitudes they will need in the future? Please explain what guides your choice when planning your ICT program. (probe for aspects uh as teamwork, creativity, communication, self-directed learning, etc) How do you use the existing ICT skills of students to facilitate learning, and how do you measure the effect?

- Please explain any influences you have on the teaching of ICT in your school? What is your vision for the use of ICT in the school? What is the school's vision for ICT does yours differ? Please explain
- Please explain how satisfied you are with your ICT teaching and the resources that are available to you. What kind of support do you need to extend the use of ICTs? How important is the leadership team in implementing ICT in your classroom?
- What opportunities does your school offer to enhance the ICT skills of educators?
- How do you improve your classroom practice particularly with ICT? Which ICT related PL opportunities have you participated in?
- Are there incentives for more staff ICT use? Do you feel under pressure to use ICT more?
- How do you share what you know and do regarding ICT and pedagogy?
- In your opinion why teachers are reluctant to integrate ICT in the classroom?
- Is there anything else you would like to tell me about your ICT journey?

Appendix D - Teaching and Learning with ICT: A self-evaluation guide – Department of Education Western Australia 2003

	Pre-Entry **Teachers engage their students in purposeful and appropriate learning experiences without the use of ICT**	Phase 1 **Teachers engage their students in sequences of purpose and appropriate learning experiences and use ICT to increase student productivity and engagement**
Facilitating student learning • connecting to CF	Application of Curriculum Framework does not involve connections to ICT	Applies ICT to specific aspects of the Curriculum Framework
• student application of ICT	Others are responsible for student use of ICT to support learning	Focus on students 'use of ICT as a tool and development of ICT literacy skills Students access to software programs as a reward
• attitude	Comfortable that existing teaching, learning and assessment practices adequate promote student learning without the use of ICT	Willing to extend their repertoire of teaching and learning strategies
• teacher as orchestrator	Designs learning experiences to engage their students without the use of ICT	Teacher assumes primary responsibility for ICT use Teacher allows for student collaboration and self-direction in some instances
• repertoire of teaching strategies	Provides learning experiences to accommodate the learning styles and needs of students without the use of ICT May allow some students to use computers if they choose to do so, particularly at home or at the library, but may feel unwilling or uninterested in changing what seems successful	Teacher experiments with new teaching strategies using ICT
• ICT access and use	ICT access and use occurs outside the classroom and do not involve the class teacher	Most ICT is computer labs and not readily accessible for classroom integration Classroom computers located in relatively isolated part of the classroom
Assessing student learning	Assessment strategies do not	Some assessment portfolios

outcomes	include the use of digital media	contain digital learning experiences
Engaging in professional learning	Professional learning does not involve learning about or using ICT	
Participating in curriculum policy and program initiatives	Does not contribute to ICT related curriculum policies or initiatives	Contributes information to assist the work of the school curriculum policy and program teams associated with ICT
Forming partnerships within the school community	Does not associate with partnerships about or using ICT	Contributes to partnerships initiated by others
Teachers' ICT skills and knowledge • peripherals	Peripherals are not used	Independently operate a limited range of peripherals Focus on technologies specific to teaching area such as MIDI keyboard, scanner or digital camera
• applications	Minimal ICT skills and knowledge	Can operate the computer at a basic level – including starting and ending sessions, using basic software applications and making simple connections Aware of applications such as spread-sheets, graphics May have rudimentary skills using a single tool, but presentations are linear and one dimensional
• Online services	Does not operate on a network Does not access online services	Knows how to browse the web but not able to make efficient searches Recognises when network is dysfunctional and reports problems to appropriate support

Phase 2 **Teachers meet diverse student learning needs through consistent application of a wide range of effective teaching, learning and assessment practices that include the use of ICT to provide opportunities for demonstration of learning outcomes**	Phase 3 Teachers are innovative in the use of highly responsive and inclusive teaching, learning and assessment practice that effectively meet the specific learning needs of individuals and groups of students using ICT to transform the learning opportunities	Phase 4 Teachers are proactive in the application of online teaching, learning and assessment strategies to provide customised and responsive learning opportunities

Applies ICT to achieve outcomes across learning areas in the Curriculum Framework Focus on students' use of ICT as a learning tool to support achievement of learning outcomes Feel in control, confident and comfortable with ICT Students access ICT through teacher directed activities Using ICT students have more opportunities to adopt roles, simulate authentic tasks, work collaboratively and independently and begin to rely on each other when questions arise ICT is applied to student-focus strategies that are enhanced with ICT ICT located mostly in classrooms and controlled by teacher Computers arranged for effective supervision by teacher and collaboration by students	Applies ICT to enrich learning activities that are authentic, multidisciplinary and demonstrate knowledge and relevance to the curriculum framework Focus on students independence in appropriate use of ICT to meet their learning needs to achieve outcomes Learning with ICT is oriented towards constructing meaning and solving problems of consequence ICT thinking, usage and integration is second nature Capable of operating independently in collaboration with others Students are self-directed and have opportunities to select and use a range of technologies for learning experiences Use of ICT is of a crucial learning tool to the achievement learning objectives Learning activities involving ICT a highly interactive, responsive to student needs and include authentic online task and audiences Classroom ICT access is the shared responsibility of teachers and students who have flexibility about reorganising the class environment according to need	Creates innovative online learning programs that support achievement of outcomes across all learning areas Focus is on students' interacting and creating online learning experiences Examines directions in online learning and provides advice to the education community Creates scaffolding for online learning for students which reflects individual learning styles and needs Employs a range of eLearning strategies – creating open-ended inquiry based tasks using online learning content management systems ICT access is readily available throughout the classroom, school and at home
Digital assessment valued by teachers and students to demonstrate achievement	Assessment tasks result in products of value to the student, teacher and broader audience that demonstrates evidence of using ICT Assessments are comprehensive and utilise a perverse range of digital media	Students, teachers and parents use eLearning in teaching, learning and assessment
Contributes to networks to collaboratively design and evaluate integrated ICT strategies Supports colleagues in their	Initiates and facilitates research and dialogue in exploring innovative applications of ICT in teaching, learning and	Leads professional learning about eLearning in teaching, learning and assessment

use of ICT	assessment	
Actively participates in school curriculum policy and program teams associated with ICT	A leader in the development of school curriculum ICT policy and strategies	An innovator and participant in school ICT policy and strategies
Actively participates in partnerships	Is a leader in the development of partnerships	Builds sustainable online learning communities with students, parents and colleagues
Comfortable using a range of peripherals Requires support in using new peripherals and solving problems Regularly applies ICT to personal and professional productivity Can save or retrieve multimedia content and other files Online information resources used where appropriate Understands and uses efficient web search methods, uses bookmarks and favourites Navigates networks comfortably and independently solves simple network problems	Able to transfer skills to new peripherals without support and use is transparent Able to transfer skills from current to new tools quickly and independently Uses a range of multimedia technologies to create, edit and communicate learning programs and products Creates and publishes online curriculum resources Collaborative tools of email, listservs, chat boards, video conferencing used regularly and appropriately Uses network resources transparently in everyday work	Actively explores new technologies and assess their potential for enhanced learning Proactive in investigating online services and tools Assesses their potential for enhancing teaching, learning and assessment Online learning experiences are investigated and created

Appendix E - Making the ICT Difference: Using ICT effectively in Teaching and Learning

I know how to make good use of the ICT around me				
Pre-entry	Level 1	Level 2	Level 3	Level 4
You do not have any idea how to use the ICT available to you.	You know how to use ICT for personal use. You have started to think about how you could employ it in your teaching.	You restrict your use of ICT to areas where you feel safe.	You know what you can and cannot do with ICT. You know how you can deploy your own ICT skills with students.	You plan for open-ended use of ICT and are happy to learn from students and colleagues.
We learn together				
Pre-entry	Level 1	Level 2	Level 3	Level 4
You have not used ICT to help share	You have used some ICT tools	You have contributed to a shared space department/school	You regularly contribute to shared document	In your contributions to shared spaces, you help to enable other
ICT helps my students work together				
You have not explored the use of ICT for group work or class discussion.	You have organised your class to allow students to work together with a piece of educational software.	You have started to think how you could use ICT to allow students to discuss their work.	You know how to improve communication and collaboration among your students using ICT.	You design the use of ICT to maximise the engagement of all your students.
I enrich activities with ICT				
You have not used ICT to bring in a real world perspective to your students' work.	You have asked students to use search engines to look for some real life examples.	You have guided students to resources that illustrate their work.	You regularly use ICT to enrich your lessons. You help your students to use the latest and most relevant resources.	You recognise the added benefits of using ICT to interact with real people
I know where my students are and where they are heading				
You do not use any ICT to judge what your students have learned.	You do not use any ICT to judge what your students have learned.	You have used ICT to assess your students' learning with a few different classes. You and your students have seen some benefits.	You share assessment data with students in a way that motivates them.	You share assessment data with students in a way that motivates them.
I use pupil feedback				
You do not use ICT so you do not get feedback on how you use it from your students.	You have tried using ICT and have had some positive feedback from your students.	You have used ICT a few times with different classes. Your students have given you enough information for you to make their experience better next time.	You have used feedback from students to improve activities. Students are more engaged in your activities after you have made your improvements. You plan to seek feedback whenever you use ICT.	You have strategies for sharing feedback and lessons learned with colleagues. You review your practice in the light of new technology.

tips, ideas and experience with colleagues.	people know about a useful resource.	resources.	spaces and use email and messaging tools to communicate with colleagues remotely.	users to participate.
In your contributions to shared spaces, you help to enable other users to participate.				
You cannot see how ICT can enhance or help you in your teaching.	You cannot see how ICT can enhance or help you in your teaching.	You use ICT for some aspects of your teaching because you have identified benefits.	You have been able to make improvements to whole class teaching, individual and group working using ICT. You are using new methods only possible with ICT.	You keep your teaching practice under review and adopt new approaches where there are proven benefits.
I stay fresh				
You never take risks with ICT.	You never take risks with ICT.	You have taken a few risks with your students learning. You have tried using some new ICT to deliver an old lesson differently.	You are developing criteria for measuring the success of new approaches using ICT.	You take opportunities to experiment with your practice. You are careful to evaluate how well things work and learn lessons from your mistakes.
I select the best				
You have no idea how to go about selecting an ICT resource.	You select your resources from those available in the school.	You make use of recommendations of colleagues and marketing materials from educational suppliers.	You have developed your own checklist of desirable characteristics in ICT resources.	You keep up-to-date with the available products and colleagues ask you for your recommendations.
I make time for teaching				
You use paper for all your personal admin.	You use school ICT systems, but you do not tend to use ICT for personal admin.	You have started to use ICT for keeping records on your students.	You make extensive use of ICT to share and process assessment data automatically, back-up important information and avoid data re-entry from one academic year to the next.	You critically evaluate new practices making judgements and recommendations about their efficiencies.

Adapted from:

Matrix: evaluate > plan < review

http://matrix.becta.org.uk/GMATRIX_18188330_87115117/1232686561166/rebrand/home/index.cfm?forcenew=yes

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